NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

Rel. No. 83-04

For Release:
IMMEDIATE

Ames Deputy Director Named
For Presidential Award

Angelo Guastaferro, Deputy Director, NASA's Ames Research Center, Mountain View, CA, has been named by the President a "Meritorious Senior Executive." The Presidential Rank is awarded to "Career Federal Executives in the Senior Service whose performance has been exceptional." The award, in his case for leadership in planetary exploration, was presented at the State Department in Washington.

A total of 16 senior executives from various NASA research centers and NASA headquarters gained the Presidential Rank.

Guastaferro also recently has been named a Fellow of the American Astronautical Society for contributions to astronautics, and received the Space Systems Award of the American Institute of Aeronautics and Astronautics, the principal U.S. professional

aerospace engineering group.

As Ames Deputy Director, Guastaferro has a range of duties. He has had a long career in space project work since receiving his Bachelor's degree in Mechanical Engineering from New Jersey Institute of Technology in 1954. He received an MBA in Research and Development Management from Florida State University in 1963.

From 1955 to 1963, he served as an officer, and then civilian, with the U.S. Air Force Armament Center at Eglin Air Force Base in Florida as an aeronautical project engineer. He joined NASA at the Langley Research Center, Hampton, VA in September 1963. He served at Langley in a variety of research and development management positions including Scout Mission Operations Manager, Viking GCMS Manager, Viking Deputy Project Manager, Rotor Systems Research Aircraft Project Manager, and the Large Space Systems Technology Program Manager.

In April 1979, he went to NASA Headquarters, to head the Planetary Division, Office of Space Sciences, responsible for planning, development, and operation of spacecraft systems for planetary exploration. At Langley, he received Special Achievement Awards in 1974, 1977, and 1978, and a NASA Outstanding Leadership Medal in 1977. At NASA Headquarters, he received the NASA Exceptional Performance Award in 1980.

Guastaferro is marrried to the former Eleanor Lago and they live in San Jose, CA.

Feb. 2, 1983

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

Rel. No. 83-06

For Release:
IMMEDIATE

Syvertson Gains Presidential Award

Clarence A. Syvertson, Director of NASA's Ames Research Center, Mountain View, CA has been named by the President a Distinguished Senior Executive. The award, presented by the President at the White House, goes to "career Federal Executives in the Senior Service whose performance has been distinguished." Syvertson was one of only 38 Federal executives so honored.

The Ames Director has also just received an Outstanding Achievement Award from the University of Minnesota, his alma mater.

Syvertson, who was cited for his outstanding management of a research institution, became Director of Ames Research Center in 1977. He was Deputy Director of the Center from 1969 until 1977. He has been with Ames since 1948, when he joined the National Advisory Committee for Aeronautics (NACA - NASA's predecessor), as research scientist and assistant branch chief. Since, he has authored 32 technical papers and articles.

Syvertson became chief of the 3.5-foot Hypersonic Wind Tunnel Branch in 1959. From 1963 to 1966, he was Director of the Mission Analysis Division. In 1966, he was named Ames Director of Astronautics, a position he held until becoming Deputy Director in 1977.

Syvertson received the NASA Exceptional Service Medal in 1971 for heading the joint Department of Transportation-NASA Civil Aviation Research and Development Policy Study, during a year-long assignment in Washington, D. C. 1970-71.

Earlier awards include the Lawrence Sperry Award from the American Institute of Aeronautics and Astronautics and the Space Act Invention Award. He was named a Fellow of the American Institute of Aeronautics and Astronautics in 1977 and a Fellow of the American Astronautical Society in 1978. He is on the Board of Governors of the National Space Club; and the Engineering Advisory Councils of the Universities of Minnesota, California, and San Jose State. In 1981, he was named to the National Academy of Engineering, the highest distninction in U.S. engineering.

He earned Bachelors and Masters Degrees in Aeronautical Engineering from the University of Minnesota, 1946-48, and completed the Advanced Management Program of Harvard Business School in 1947.

A native of Minneapolis, Minn., Syvertson now lives with his wife, Joann, and daughters in Saratoga, CA.

- end -

Feb. 16, 1983

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Evvie Rasmussen 415-965-5091

Release No. 83-09

For Release:

IMMEDIATE

RECYCLING COULD SAVE MONEY FOR FUTURE NASA SPACE MISSIONS

Inhabitants of a future space station could save millions of dollars by growing their own food.

A study conducted by Boeing Aerospace Co., Seattle, for NASA's Controlled Ecological Life Support System (CELSS) program at Ames Research Center looked into the recycling needs of future NASA missions.

NASA astronauts have always carried supplies such as food and oxygen and have stored waste. But weight penalties and transportation costs for longer missions and larger crews could prohibit storing or resupply in the future. At some point, recycling refuse into consumable supplies will become economically attractive.

Boeing researchers looked at NASA planning forecasts for the next 50 years and examined six typical missions to determine which of them could benefit from recycling. The missions examined include:

* A Low Earth Orbit (LEO), Low Inclination space station;

* A LEO, High Inclination space station;

(more)

March 11, 1983

* A military command post in an orbit at about 212,430 kilometers (132,000 miles) altitude;

* A Lunar Base;

* An Asteroid Base; and

* A Mars Surface Exploration mission.

For the study, weight and cost of storage and resupply were compared to weight and cost of equipment needed to grow food and recycle waste.

Three systems were compared in the study:

* All food provided by storage and resupply; water and oxygen recycled by physical-chemical processes.

* Plant growth to contribute 50 percent of the diet, with 50 percent supplied as packaged food; water and oxygen recycled by both physical-chemical and biological processes.

* Plant growth to contribute 97 percent of the diet, a vegetarian diet, with the remaining three percent supplied by vitamins such as B-12, seasonings and other condiments; water and oxygen recycled by biological processes.

Although the study indicated recycling would save money for all long-duration missions, it was found to be impractical for the Mars mission because of its relatively short duration. The most effective use of recycling was the Low Earth Orbit Low Inclination space station -- the earliest of the missions planned -- this would be a permanently occupied station at an inclination of 28.5 degrees.

The study envisioned this station as a four-to-12-person center responsible for assembly and construction of complex spacecraft, service and basing of upper stages and service of free-flying satellites.

For a space station which would operate longer than six years, regenerating 50 percent of the diet is less costly than resupplying the required food.

If the station operates more than eight years, producing 97 percent of the diet is more economical than resupplying an equivalent amount of food. A conservative estimate indicates this system would save at least $68 million over a 15-year space station lifetime.

Other missions studied and their results:

* Low Earth Orbit -- High Inclination: A four-person, scientific station to investigate various aspects of the Earth and Sun, located in a Sun-synchronous orbit at an inclination of about 97 degrees. The system using plants to contribute to 50 percent of the food needs would become cost-effective at 5 1/2 years and a system contributing 97 percent would be best used for seven years, compared to total resupply.

* A command post in a circular orbit, supporting four to 24 people with infrequent resupply, would find a 50 percent system to be cost effective after about 10 years. By 15 years, the potential cost savings for a 50 percent system amounts to $30 million. A 97 percent system would be cost-effective at about 13 years, when compared to the cost of resupplying the post.

* Lunar Base: A habitat located on the lunar surface with 12 to 48 personnel, primarily concerned with transporting lunar soil to lunar orbit for use in construction and manufacturing missions, would find a 50 percent system cost-effective at 5 1/2 years and a 97 percent at seven years, as compared to the cost of resupply.

(more)

* Asteroid Base: A mining mission to extract minerals from an asteroid belt, using as many as 5,000 personnel, would use the 97 percent system to show an economic break-even point at about 2 1/2 years -- about the time of the first resupply and rotation cycle.

* Mars Surface Exploration: A Mars mission involving extensive travel time (about 1,000 days) and a manning commitment of eight personnel would call for all food to be stored and/or resupplied. A 50 percent system would not pay off for five years and a 97 percent system would not be cost-effective for nine years. Such extended durations are outside the scope of this mission.

The CELSS program is under the jurisdiction of the NASA Office of Space Sciences and Applications and is managed at Ames by Robert MacElroy.

#####

March 11, 1983

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

Rel. No. 83-10

For Release:

IMMEDIATE

FACT SHEET

Pioneer 10, First Spacecraft to Leave the Solar System, Passes Beyond All the Known Planets.

Pioneer 10 Beyond the Known Planets

On June 13th of this year, the U.S. unmanned spacecraft, Pioneer 10, will cross the orbit of Neptune. With that crossing, Pioneer will be farther out from the Sun than any known planet, and will, in effect, have left the solar system. Though Pluto is normally the outermost planet, its orbit is so elliptical (elongated) that for the next 17 years it will be inside Neptune's orbit, and Pluto will never again catch up with Pioneer.

This first flight by a spacecraft beyond the planets is an event which will occur only once in human history.

Pioneer carries a message for any intelligent beings who might find the spacecraft, which after traveling 3.5 billion miles is by far the longest-distance letter ever sent.

Other definitions of solar system limits exist. Some are: the proposed comet belt (Oort cloud) at about 50,000 astronomical units (4 trillion 650 billion miles out from the Sun), for example; or the fluctuating boundary between the Sun's atmosphere (the heliosphere) and the interstellar gas, at perhaps five to ten billion miles out.

However, the most tangible, obvious, and popular of these limits is the point outside all the known planets, 2.8 billion miles from the Sun.

Experts at NASA's Deep Space Network expect to be able to track Pioneer out to somewhere beyond five billion miles.

NASA and other groups plan to mark the historic flight of Pioneer, the first man-made object to leave the solar system, with ceremonies involving Pioneer participants, investigators, and other interested people.

Since launch in 1972, Pioneer 10, the first spacecraft to Jupiter, has traversed the asteroid belt, survived Jupiter's punishing radiation belts, and operated almost without flaw. By June 13, 1983, Pioneer 10 will have traveled 3.59 billion miles on its flight path, will have received over 98,900 commands from Earth, and transmitted more than 126 billion bits of scientific data. At Neptune-orbit-crossing, 2.8 billion miles out, rate of travel for Pioneer will be 30,558 mph.

The Pioneer 10 project is managed by NASA's Ames Research Center, Mountain View, CA. Pioneer 10 was built by TRW's Space & Technology Group, Redondo Beach, CA. The spacecraft had an original design life of 21 months and has performed almost perfectly for more than 11 years.

New Jobs for Pioneer

With one exception, the far-traveling U. S. spacecraft continues to function well, and is currently engaged in a new enterprise, defining the extent and behavior of the Sun's atmosphere, the magnetic bubble which contains the Sun and the planets. This "bubble" in the interstellar medium is called the heliosphere.

Pioneer 10 data also is currently being used to seek a possible dark star companion to the Sun, for which there is significant scientific evidence (unexplained deviations in the orbits of Uranus and Neptune). Less likely, these deviations could be due to a relatively close-in tenth planet. Because of its great distance away, Pioneer also will provide a unique instrument for attempting the first detection of gravity waves employing enormously long wavelengths never before observable.

The Plaque

Pioneer carries a message to any intelligent life who might find the spacecraft on its interstellar wanderings. This message is a sort of drawing-map, engraved on an anodized aluminum plaque. "The plaque" shows location of the Earth and Solar System, a man and a woman, and some points of basic science.

Over the next 850,000 years, Pioneer's closest approach to any star system probably will be to the star, Ross 248. This will take place 32,610 years from now, with passage at 3.27 light years from the star (a big distance). Star trajectories are not well-known, and beyond 850,000 years, closer approaches may well occur. At typical star-separation distances, Pioneer might expect a relatively close approach to a star system on an average of once every million years.

Pioneer 10 will be farther out than Pluto at 2 p.m. PDT on April 25, 1983, 4,472,497,438 km (2,779,209,908 miles) from the Sun. (At Pluto distance, Pioneer's speed of travel will be 30,613 mph.)

At 5 a.m. PDT, on June 13, 1983, the spacecraft will cross the orbit of Neptune at 4,527,978,612 km (2,813,685,909 miles)

from the Sun. It will then be outside all of the known planets in the solar system.

At Pioneer's Neptune distance of 2.81 billion miles, it will take four hours and 20 minutes for spacecraft data, traveling at the speed of light, to reach the Pioneer Operations Center at NASA's Ames Research Center, Mountain View, CA. This is a round-trip communication time of 8 hours and 40 minutes. At Pluto distance, one-way light time will be 4 hours and 16 minutes. At Neptune distance, communication time will be increasing at an average of about one minute every four days.

Despite damage from intense Jovian radiation, and hits by tiny micrometeoroids, plus 11 years of continuous operation, almost all systems are performing well. Pioneer's magnetometer ceased to function in 1975, but experimenters can calculate the interplanetary field from charged particle trajectories, magnetic data already gathered, and several correlations from five other Pioneer scientific instruments.

Scientists await current spacecraft findings "with intense excitement," says Dr. James A. Van Allen, University of Iowa, Pioneer 10 experimenter, "because we think the Sun is typical of a majority of the stars in the universe. It's the only star we can measure from 'close up'. Finding the extent and exact mechanisms of the Sun's atmosphere will tell us a great deal about the Sun itself, about the interstellar gas surrounding the solar system, and hence about stars in general."

The Heliosphere

The picture now emerging seems to show that the heliosphere is enormous, far larger than predicted. The heliosphere (created by the million-mile-an-hour solar wind, blowing out from the Sun in all directions) appears to be a tear-shaped magnetic bubble. The bubble is "streamlined" by the motion of the solar system through the interstellar gas. (See illustration.)

Pioneer is traveling "down the tail" of the heliosphere tear drop. The spacecraft is seeking the "skin" of this heliospheric bubble, the boundary between the Sun's atmosphere and true interstellar space. No one knows, but scientists think this boundary region may lie between five and 10 billion miles from the Sun.

At the long-lived spacecraft's current distance, the Earth would be seen as a pin point of light, never more than 2.2^{o} away from a Sun still intensely bright, but no larger than a pin head. Because of this huge distance, and the decline in brightness of the Sun, Pioneer's sun sensor will not be able much longer to provide the sun pulse, which gives rotational position of the spinning spacecraft several times a minute. However, NASA-Ames mission controllers have devised, and will soon be using, a method of making star maps with the Pioneer camera (Imaging Photopolarimeter) to provide the needed rotational and attitude data.

Pioneer-10 Accomplishments

Pioneer 10 has an array of achievements and discoveries. Some are:

1. First trip to Jupiter.

2. First crossing of the Asteroid Belt and finding that it presents little hazard to spacecraft.

3. Discovery that Jupiter is a liquid planet.

4. First model of Jupiter's huge, pulsating, magnetosphere and tremendously powerful radiation belts.

5. First accurate measurements of mass and densities of Jupiter's planet-sized moons, key to the planet's formation history.

6. First closeup pictures of Jupiter's Great Red Spot and belts and zones showing details of atmosphere circulation.

7. Proof of origin of the gegenschein and zodiacal light (interplanetary dust).

Other Recent Findings

Recent Pioneer discoveries about the space at the edge of the solar system raise other new questions.

We now believe the heliosphere bubble "breathes" in and out once every 11-year solar cycle, says Dr. John Simpson, University of Chicago, Pioneer experimenter.

The shock waves of the enormous storms on the Sun seem to persist in the heliosphere for as long as a year, probably changing the heliosphere bubble's shape, as if it were a huge pulsating jelly fish.

"It's hard to overstate the interest of the physics coming out of this phase of the Pioneer mission." comments Dr. Aaron Barnes, NASA-Ames astrophysicist. "We are constantly entering unexplored territory, and we really don't know what we'll learn about our local star."

Other recent findings about the heliosphere:

1) The solar wind was expected to slow with distance from the Sun, but this has not happened. Almost no motion energy has been lost as heat.

2) The primary source of turbulence in the outer heliosphere is storms on the Sun, not solar wind collisions.

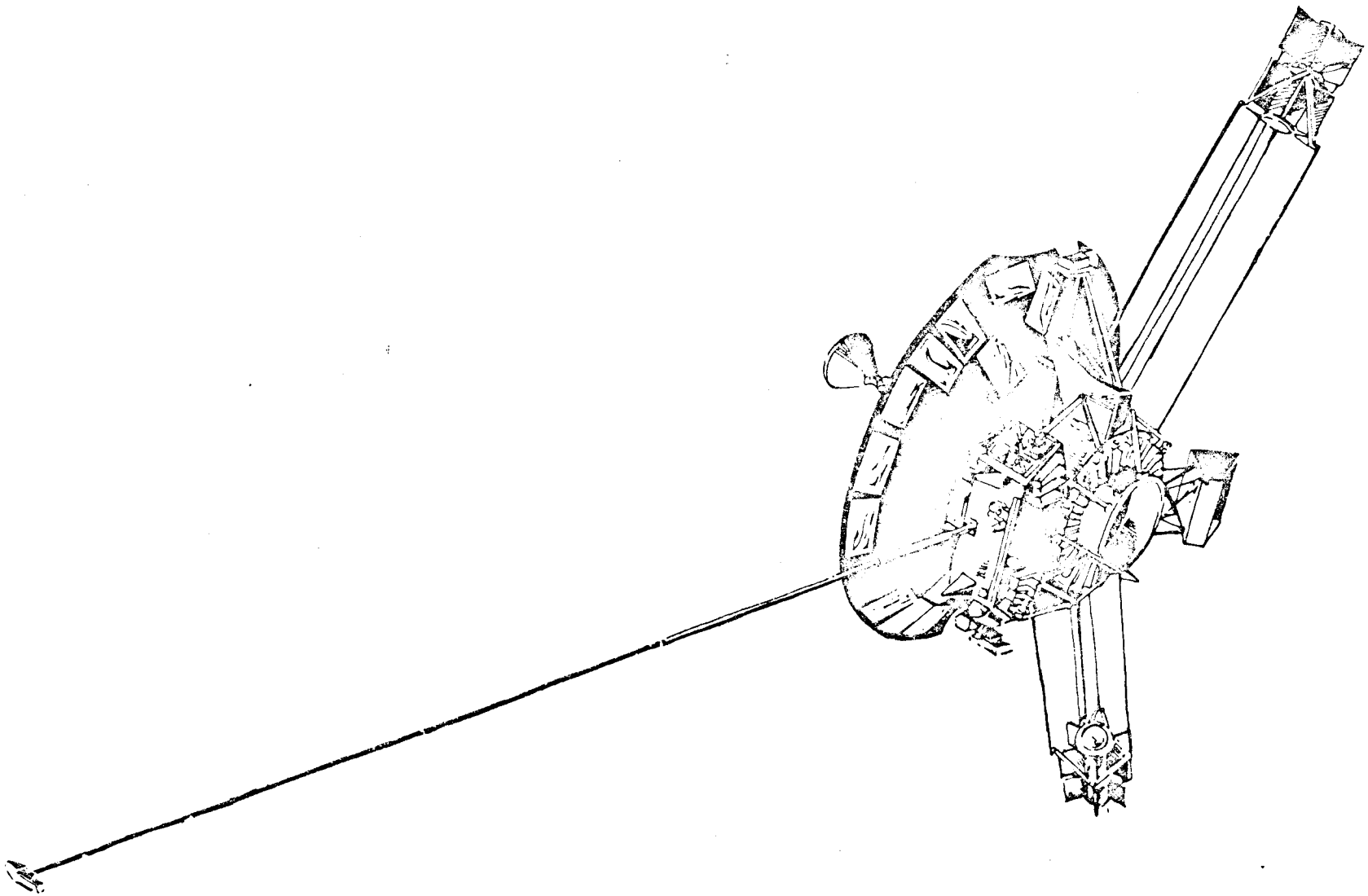
3) Near solar maximimum, cosmic ray particles incoming from the galaxy in all velocity ranges (even near light speed) become half as numerous or are shut out completely from the heliosphere.

4) For unexplained reasons, high velocity streams of electrons from Jupiter moving through the heliosphere don't wobble as expected from the planet's axial tilt.

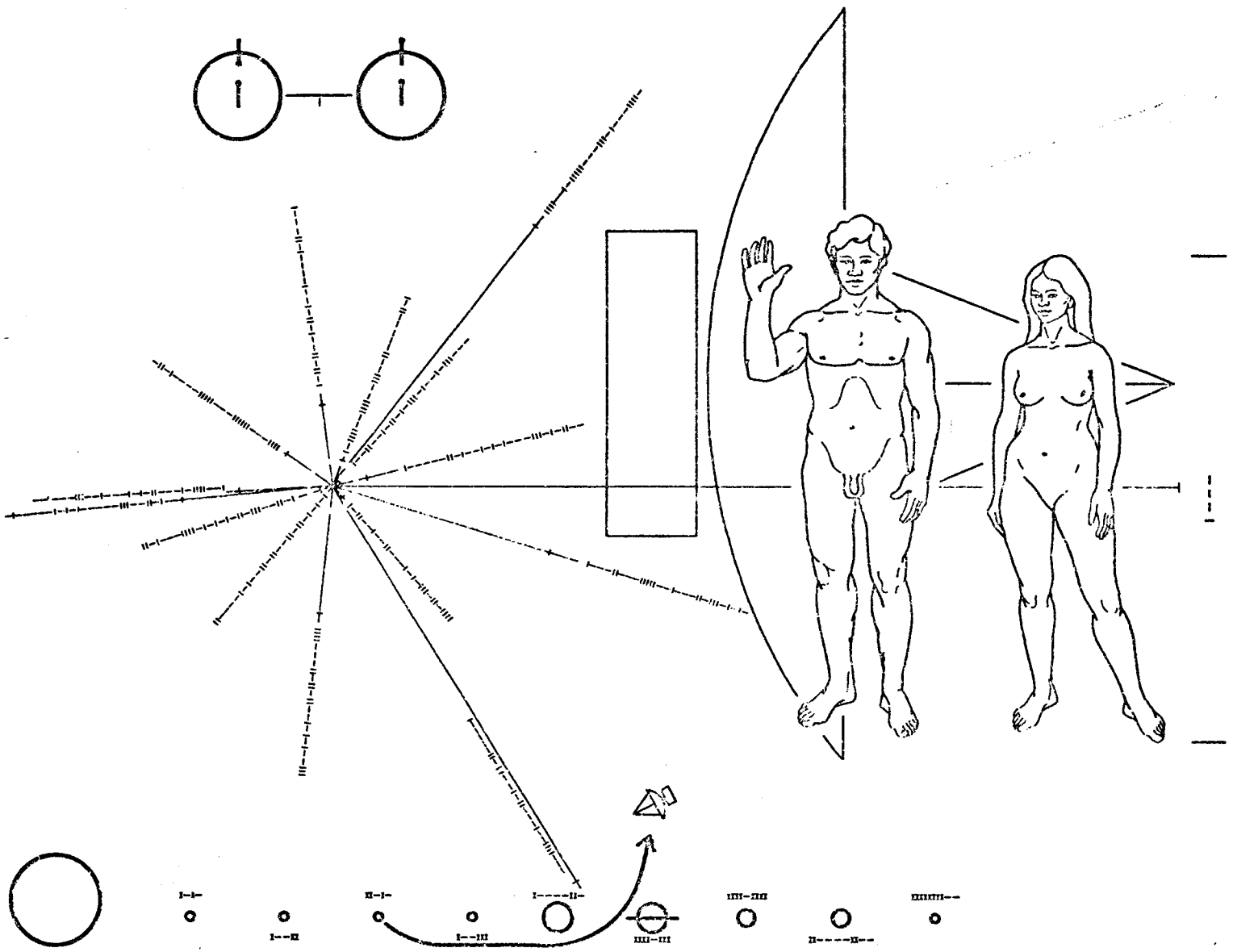
5) The heliosphere is bisected by a 'flapping' current sheet, aligned with the Sun's equator, and believed to extend to the interstellar boundary.

6) As solar storm activity builds up, the heliosphere is believed to deform into a more oval shape lined up with the Sun's equator, from its rounder shape at solar minimum. It also may expand in size.

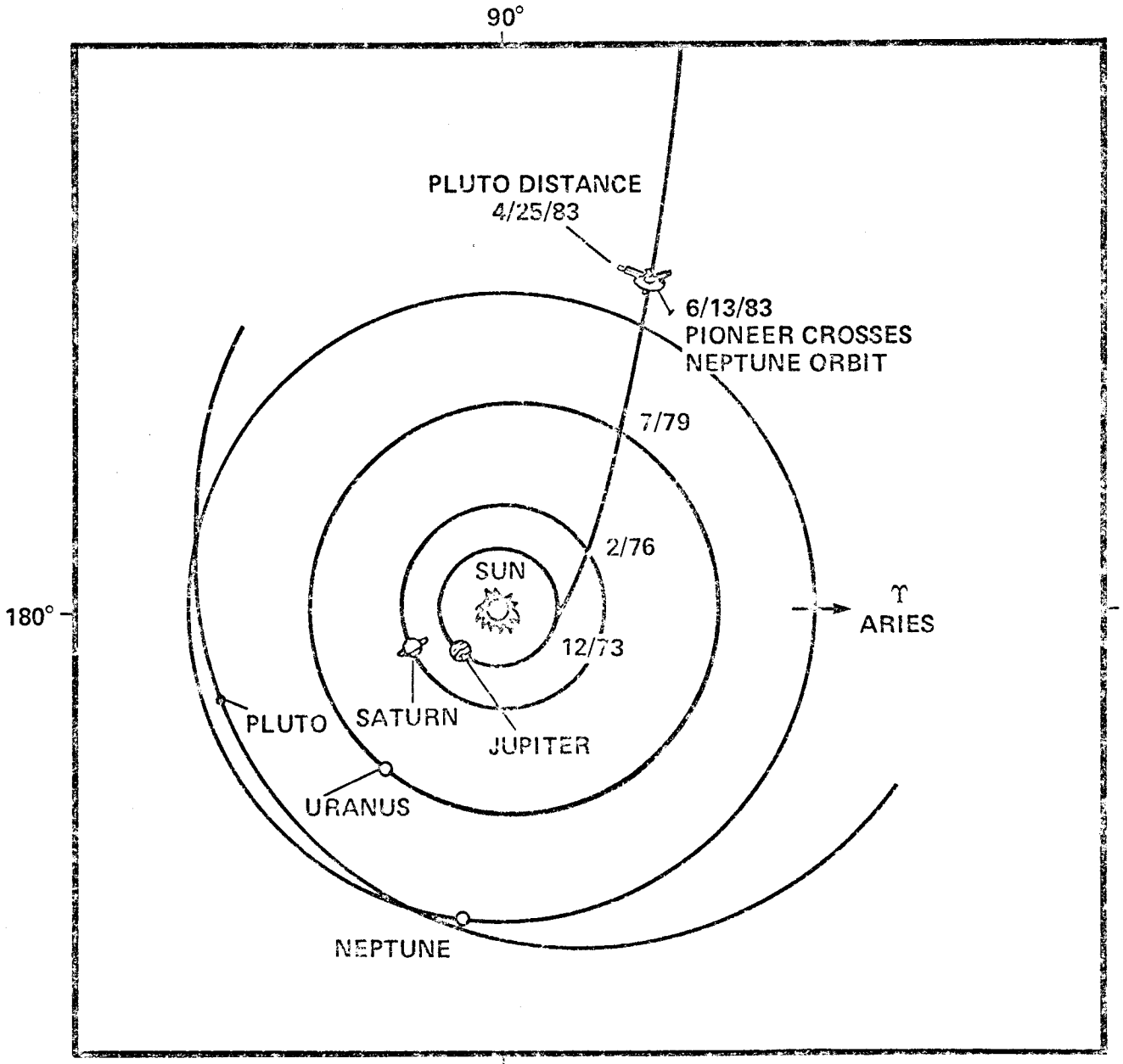
March 16, 1983



PIONEER 10 PLAQUE

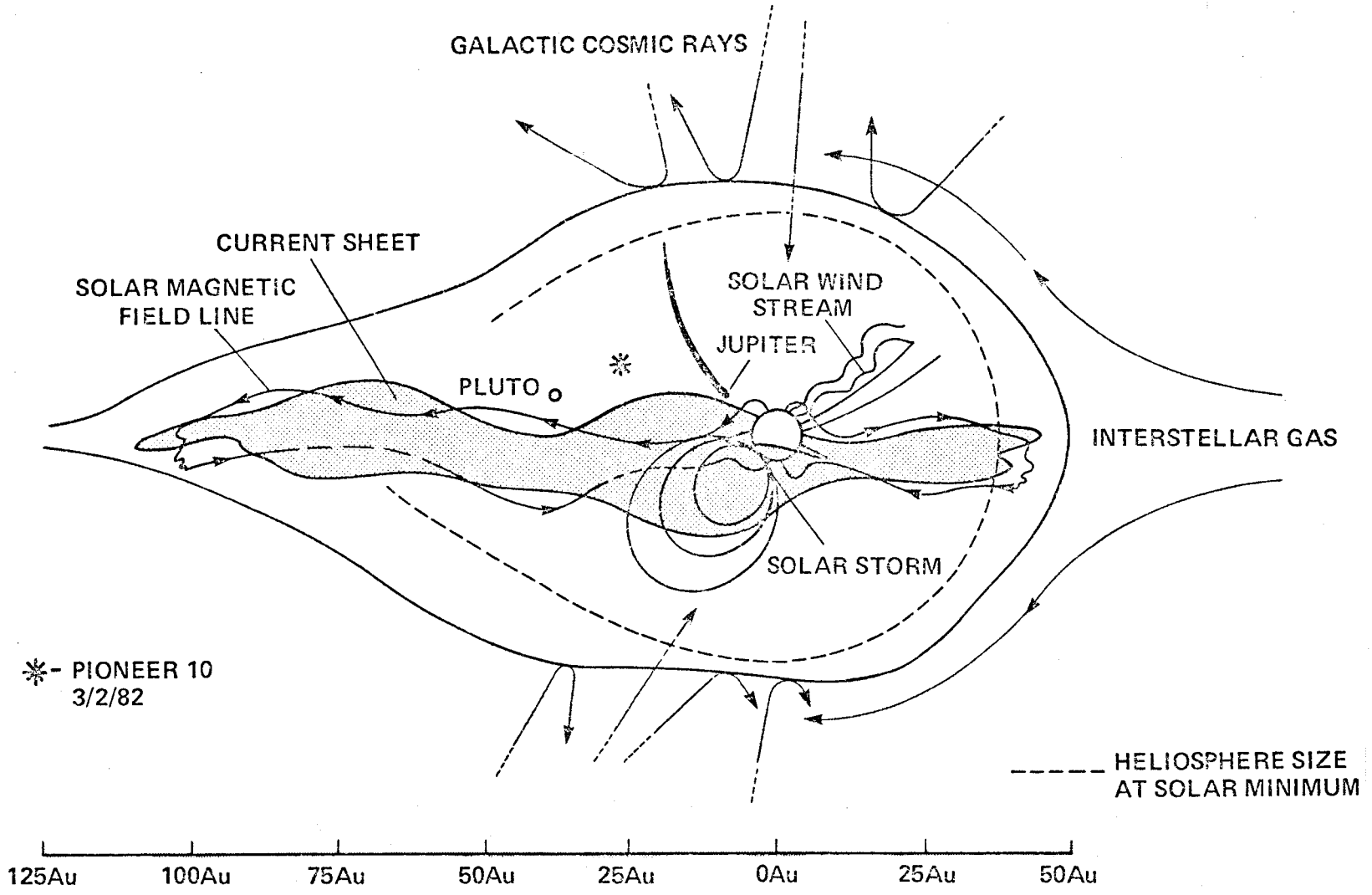


PIONEER 10 BEYOND KNOWN PLANETS



NASA Ames Research Center
March 1983

HELIOSPHERE AT SOLAR MAXIMUM



NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

IMMEDIATE

Peter Waller 415-965-5091

Rel. No. 83-11

To editors:

The attached Fact Sheet describes the passage, for the first time in human history, of a spacecraft beyond all the known planets.

Because this is a notable occurence (and to some extent because of the precedent-breaking record already established by the spacecraft, Pioneer 10), news media may well want to take special note of the event.

Various groups, including NASA, plan to mark the occasion with ceremonies and other activities.

These will include an event in Washington for Congress, the Executive, industry, and the public; ceremonies at TRW, Redondo Beach, CA, builder of the spacecraft; and at NASA's Ames Research Center, Mountain View, CA, Pioneer Project manager; actions by various scientific bodies; presentations to Congress, and similar activities.

For media such as TV and magazines which may need long advance notice, NASA- Ames, NASA-Headquarters, and TRW have assembled substantial material on this event. Photos, TV clips, spacecraft and solar system animation, interviews with scientists, and other material can be obtained from:

Charles Redmond, Code E-6 (202) 755-3054 or 755-8370
NASA Headquarters
Washington, D.C. 20546

Les Gaver, Code LFD-10 (202) 755-8366
NASA Headquarters
Washington, D.C. 20546

Peter Waller, Public Affairs (415) 965-5091
NASA-Ames
Moffett Field, CA 94035

Julie Wright, Public Relations Manager (213) 536-1500
TRW Electronics & Defense, Bldg. E-2-9063
1 Space Park
Redondo Beach, CA 90278

March 16, 1983

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

3/31/83

Larry King 415/965-5091

For Release:

Release No. 83-12

IMMEDIATE

ECLIPSE PROVIDES NEW SOLAR DATA

An international team of scientists flying through the moon's shadow during a total eclipse have discovered the sun may be bigger than it looks.

New infrared measurements of the sun were made from NASA's Kuiper Airborne Observatory, a four-engine jet aircraft equipped with a large infrared telescope, flying at 13 kilometers (43,000 feet) over the Pacific Ocean on July 31, 1981. The scientists found that the diameter of the sun viewed in infrared light is significantly greater than in visible light, as it is normally seen. This is important for studying the upper atmosphere of the sun. The results were reported in a paper published in the January first issue of the Astrophysical Journal.

Almost all of the infrared radiation emitted by the sun comes from the upper solar atmosphere, called the chromosphere. The chromosphere is a hot thin layer of gas lying several thousand kilometers above the surface of the sun. The

-more-

chromosphere also emits almost all of the sun's ultraviolet radiation, which causes millions to tan - and millions more to burn - every spring and summer.

Scientists believe these new infrared measurements indicate regions of dense material extending higher into the chromosphere than previously realized. The scientists are busy studying the new infrared data to understand more about the temperature and structure of the solar chromosphere.

The observations were a collaborative project made by a team of scientists and technicians from Hawaii and California and the United Kingdom. The effort was headed by infrared astronomer Dr. Eric Becklin from the University of Hawaii. Two other infrared scientists, Drs. Michael Werner, from the NASA-Ames Research Center, and Ian Gatley, from the United Kingdom Infrared Telescope, at Mauna Kea were instrumental in the project. Three solar scientists from Hawaii, Drs. John Jefferies, Charles Lindsey, and Frank Orrall worked on the project.

The Kuiper Airborne Observatory (KAO) carries its 91.5-centimeter (36-inch) infrared telescope to high altitudes to observe faint infrared radiation from stars, dust clouds, and distant galaxies.

This was the first time the KAO had been used to observe the sun.

Most infrared radiation from astronomical sources is absorbed by water vapor in the earth's atmosphere. The KAO can ascend to the earth's stratosphere to observe infrared light that

cannot penetrate to the earth's surface. For this observation the KAO was flown to Japan from its base at Ames Research Center in California. From Japan it was able to reach the North Pacific, not far from the coast of Siberia, to observe the eclipse in full totality. Precise navigation was required to intercept the moon's shadow as it swept across the earth's surface at over 1,600 kilometers per hour (1,000 mph).

The sharp edge of the moon, as it eclipsed the edge of the sun, was used to discriminate the infrared edge of the sun at the point where the solar crescent disappeared. This allowed a much finer discrimination of the sun's edge than can normally be resolved by a powerful telescope. The continued detection of infrared radiation several seconds after all visible light from the sun was totally eclipsed shows that the infrared edge of the sun extends more than 2,000 km (1,250 miles) outside the visible edge.

This is a much greater extent than is predicted by existing models of this region of the sun. The chromospheric density structure suggested by these new observations may be related to other features of the solar atmosphere, such as magnetic storms and sunspots, and ultimately to the solar flares which disrupt terrestrial communications.

-end-

3/21/83

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter Waller 415-965-5091

IMMEDIATE

Release No. 83-13

To Editors:

On Monday, April 25, at 2 p.m. PDT, the Pioneer 10 spacecraft--which made the first trip to Jupiter, first passage of the Asteroid Belt, and first use of planetary swing-by for velocity increase--will be farther from the Sun than the planet Pluto.

This will be the first time in human history that a spacecraft will have traveled beyond eight of the nine planets, almost 2.8 billion miles from the Sun. Six weeks later, Pioneer will cross Neptune's orbit and be outside all of the known planets, effectively outside the solar system. (Because its orbit is so elliptical, Pluto, normally the outermost planet, is currently inside Neptune's orbit and will be for the next 17 years.)

A news briefing on these events, and current Pioneer science return and operations, will be held at NASA's Ames Research Center, Mountain View, CA at 10 a.m., April 25, 1983.

A film clip will be available for TV and still photos for print media. There will also be a model of the solar system, with spacecraft. A tour of the Pioneer Control Center will show operations, outgoing commands, and incoming science from 2.8 billion miles away. Light time for the Pioneer radio signal is now four hours and 20 minutes one-way.

Reporters and photographers can also be present in the Control Center at the moment of Pluto distance crossing, 2 p.m. PDT, as well as at the time the signal sent from the spacecraft at Pluto distance reaches the Earth , 6:20 p.m. PDT.

Reporters planning to attend should come to the NASA gate of Moffett Field, from which they will be directed to the briefing in the Space Sciences auditorium at Ames.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

John Gustafson

For Release

IMMEDIATE

Release No. 83-14

Pioneer 10 To Pass Beyond Pluto

On April 25th, at 2:00 p.m. PDT, the Pioneer 10 spacecraft will be farther from the Sun than the planet Pluto. This will be the first time in human history that a spacecraft will have traveled beyond eight of the nine planets, almost 2.8 billion miles from the Sun.

That will leave only Neptune of the nine known planets lying still farther out. Pioneer 10's outbound path will cross Neptune's orbit on June 13th. On this date, the spacecraft will effectively leave the solar system.

Normally Pluto is the outermost planet but because its orbit is very elliptical (like a slightly squashed circle with the Sun off-center), Pluto can sometimes be nearer to the Sun than Neptune. This will be the case for the next 17 years.

Pioneer 10 was the first craft to travel to Jupiter, made the first passage through the Asteroid Belt, and was the first to use planetary swing-by for velocity increase. Pioneer is managed by NASA's Ames Research Center, Mountain View, CA.

Pioneer 10 data is currently being used to seek a possible dark star companion to the Sun, which is suggested by unexplained deviations in the orbits of Uranus and Neptune. Because of its huge distance, Pioneer also provides a unique instrument for attempting the first detection of gravity waves by measuring enormously long wavelengths, never before observable.

When Pioneer passes Pluto's distance it will have traveled nearly 3.5 billion miles on it's curving flight path across the solar system.

For the Space Shuttle Challenger to cover an equal distance it would have to orbit the Earth 107,690 times. At Challenger's orbital speed of 17,000 miles an hour, this would take over 20 years of continuous orbital travel.

Radio signals, moving at the speed of light, require more than four and a quarter hours to cross the vast distance between Earth and the spacecraft.

NASA scientists typically send Pioneer 10 a message when they arrive at work in the morning and don't receive a reply until quitting time, eight and a half hours later.

The light-travel time between Earth and Pioneer increases by about a minute every four days.

Pioneer 10 is traveling away from the Sun at over 30,000 miles per hour. Escape velocity from the solar system is 25,725

miles per hour.

Pioneer will be the first human artifact to leave the solar system.

Launched March 2, 1972, Pioneer 10 was designed to last for the 21 months it took the craft to rendezvous with Jupiter, its primary mission.

But even after more than a decade in space, scientists are able to operate the spacecraft almost without a flaw and get back valuable scientific information.

The spacecraft sends its information with an eight-watt radio transmitter, a power equivalent to a Christmas tree light. It uses a parabolic radio dish to focus the radio signal into a narrow, degree-and-a half wide, conical beam.

Despite such a "tight" beam, by the time the signal reaches Earth it has spread over an area more than eleven million miles across.

When it is received by the 210-foot-diameter radio antennas of the Deep Space Network (DSN), the original eight-watt signal has weakened to twenty thousand trillionths of a watt (.000,000,000,000,000,000,001 watt).

According to Pioneer Project Manager Richard Fimmel, if the signal from the spacecraft could be collected and stored with one of the DSN radio dishes for 67 million years, the total energy collected would not be enough to power a seven-and-a-half-watt light bulb for even one-thousandth of a second.

That such a tiny signal is detectable at all is a tribute to the tremendous increases in antenna sensitivity that have

occurred since the spacecraft's launch.

NASA hopes to track Pioneer 10 with the DSN radio receivers for another eight years, out to a distance of five billion miles, 2.2 billion miles beyond the spacecraft's present distance.

Tracking the spacecraft out to such a distance will provide scientists the information to build a much better picture of the "heliosphere."

The heliosphere is the diffuse extension of the Sun's outer atmosphere that surrounds the entire solar system -- a huge magnetic "bubble" created by the million-mile-an-hour solar wind.

Pioneer 10 has discovered that the heliosphere extends much farther than previously thought. Previously, the heliosphere's boundary, or "heliopause," was believed to lie just beyond Jupiter.

But Pioneer 10 is six times that far out and has yet to encounter the boundary.

Pioneer 10 has found that the heliosphere changes in response to magnetic storms on the Sun. It alters it's bubble-shape as if it were a huge, pulsating jellyfish.

The heliosphere also responds to the normal cyclic activity of the Sun.

We now believe the heliosphere-bubble "breathes" in and out once every 11-year solar cycle, says Dr. John Simpson, University of Chicago, Pioneer experimenter.

Pioneer carries with it a message to any intelligent life who might encounter the craft on it's interstellar wanderings.

This message is part map and part drawing engraved on a

gold-anodized aluminum plaque. The map shows the location of the solar system and Earth referenced to easily identified objects (pulsars) in the galaxy.

The plaque also features a drawing of a man and a woman, with the man's hand raised in a gesture of greeting, and some basic scientific points to be used in interpreting the diagram.

Other Pioneer 10 accomplishments include:

The discovery that Jupiter is a liquid planet;

The first model for Jupiter's huge, pulsating magnetosphere and tremendously powerful radiation belts;

The first accurate measurements of the masses and densities of Jupiter's planet-sized moons;

The first close-up pictures of Jupiter's Great Red Spot and the circulation belts and zones of the giant planet's swirling atmosphere.

Pioneer 10 has also provided proof that interplanetary dust causes gegenschein and the Zodiacal light.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter Waller 415-965-5091

John Gustafson

IMMEDIATE

Release No. 83-18

Pioneer 10 Spacecraft Departs Solar System

The first departure of a spacecraft from the solar system will occur on Monday, June 13th at approximately 5:00 am PDT.

At that time, the Pioneer 10 spacecraft will cross the orbit of Neptune and be farther from the Sun than all of the known planets. Activities in several parts of the country will commemorate Pioneer's achievement.

Pioneer's final step across Neptune's orbit happens at a distance of 2.81 billion miles from the Sun. Neptune is currently the outermost planet. Pluto will be nearer to the Sun than Neptune for the next 17 years because part of its elongated oval orbit lies inside Neptune's orbit.

Pioneer is managed by NASA's Ames Research Center, Mountain View, California. It was the first spacecraft to cross the Asteroid Belt, fly by Jupiter, chart Jupiter's intense radiation

belts, measure the mass and density of its four planet-sized moons, and find that Jupiter is a liquid planet. It now becomes the first craft to depart from the solar system.

Scientists calculate that Pioneer will travel among the stars virtually forever because the vacuum of interstellar space is so empty and, hence, non-damaging to spacecraft. Pioneer should even outlast the solar system itself when, about five billion years from now, the Sun becomes a Red Giant and engulfs the Earth.

"It's exciting to think about the spacecraft," says Catherine McGhan, mission operations manager. "Every time a Deep Space Network receiver locks onto Pioneer, it's like an athlete setting a record."

Pioneer continues to gather and relay detailed scientific information from the previously unexplored outer reaches of the solar system. Virtually all systems are performing flawlessly after more than 11 years in space.

"Tracking Pioneer for so long lets us measure the Sun's full range of phenomena, something we'll never do for similar stars even with the best telescopes," says project scientist Palmer Dyal.

Perhaps the most important finding about the outer solar system is that the Sun's atmosphere, the heliosphere, does not end at the orbit of Jupiter as previously believed. Pioneer is now six times that distance and has not yet detected the boundary of the solar atmosphere or any lessening of the Sun's influence. Scientist's now believe that this boundary may be twice Pioneer's

present distance.

A tenth planet or, more likely, a dark star at the outer fringes of the solar system may well be located by measuring changes in Pioneer's flight path. Such an object has long been suggested by unexplained irregularities in the orbits of Uranus and Neptune.

Tracking Pioneer to its great distance also gives scientist's a unique opportunity for detecting "gravity waves," a form of radiation predicted by Einstein's theory of relativity.

In theory, huge events such as collisions between galaxies or two massive black holes would "rattle" the entire universe, and such waves may be detectable in the extremely long wavelengths (one to three billion miles) that Pioneer can measure.

Scientists have been expecting that as Pioneer nears the limit of the Sun's influence it should detect increasing numbers of cosmic rays. But even at almost three billion miles, the magnetic field of the heliosphere still shelters the solar system from all but the fastest-moving cosmic ray particles.

Because Pioneer will last in interstellar space for billions of years, it is being used much as a castaway uses a bottle to carry a message across the seas.

Pioneer carries an easily-interpreted message in the rare event that it encounters any beings on its journey. Engraved on a gold-anodized aluminum plaque, the message features a drawing of a man and woman, a diagram of the solar system, and a map locating the solar system with reference to some galactic

"lighthouses" (pulsars).

Pioneer crosses Neptune's orbit at 2,813,685,909 miles from the Sun and departs at 30,558 miles per hour to travel among the stars in Sol's neighborhood of the Milky Way. It joins those stars in orbit around the center of the galaxy.

Pioneer's first encounter with a star happens 10,507 years from now when it passes Barnard's Star at a distance of 3.8 light years. Barnard's star, a cool, small red star, changes its position in the sky faster than any other star.

The spacecraft's nearest encounter will be with a star named Ross 248, a red dwarf "flare" star. Ross 248 gives off flares similar to solar flares only much more powerful. Pioneer passes Ross 248 at 3.2 light years more than 32,000 years from now.

Also among the scores of stars Pioneer will pass in the next 800,000 years is Altair, a star hotter and bigger than the Sun and nearly nine times as bright.

Pioneer's primary mission was an encounter with Jupiter in December 1973, 21 months after its launch in March of 1972. Now, nearly a decade later, the craft is on an "extended" mission looking for a tenth planet and gravity waves, charting galactic cosmic rays, and making a range of findings about the heliosphere. (See Pioneer 10 Background, Rel. No. 83-19.)

The heliosphere is created and maintained by the solar wind, a million-mile-an-hour flow of charged atomic particles "boiling" off the Sun's surface.

Pioneer is seeking the heliopause, the boundary where the solar wind "dies" as it hits the interstellar gas. Scientists

believe that at this boundary the solar wind piles up and is heated in a shock front.

The leading edge of the heliosphere is thought to be blunted and the trailing edge stretched out as the solar system moves at 66,000 mph through the interstellar gas. Because Pioneer 10 is thought to be traveling down the extended "tail" of the heliosphere, opposite the direction of the Sun's motion, it may not reach the heliopause while it still has electrical power.

Project manager Richard Fimmel expects that NASA will be able to track Pioneer until the craft's radioisotopic generators give out around 1994. The craft would then be some five billion miles from the Sun.

Even now, though, Pioneer's sun sensor is almost insensitive to the Sun's fading image. To get information for determining Pioneer's orientation, controllers are reprogramming the camera, which returned pictures during Pioneer's passage by Jupiter, the Imaging Photopolarimeter (IPP). The IPP will detect star images and take over the sun sensor's duty.

"The science instruments need to know the craft's orientation," says Alan Fernquist, assistant flight director for Pioneer. Without that information they can, for example, only tell how strong the solar wind is, but not which way it blows.

Once Pioneer enters interstellar space it will last essentially forever. The most damage Pioneer suffers is due to the solar wind and micrometeoroid impacts.

The solar wind wears away a tenth of a centimeter of the Moon's unprotected surface in ten billion years. Micrometeoroid

impacts would remove a full centimeter in this same time.

Pioneer will experience these slow erosive processes for less than 100 years, so their total damage will only be slight.

In interstellar space only cosmic rays disturb the craft. But they either pass completely through the craft or only temporarily disturb the electrons in the metal of the spacecraft. Cosmic rays have almost no net effect on Pioneer 10.

Pioneer's departure from the solar system will be honored by ceremonies at Ames Research Center in Mountain View, California, at TRW in Redondo Beach, California, and at the Smithsonian Institution in Washington, D.C.

Ames Research Center is the site of the Pioneer operations control center which controls and communicates with the spacecraft.

TRW Space and Communications Group built both Pioneers 10 and 11.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

X 6/83

For Release

Peter Waller 415-965-5091
John Gustafson

IMMEDIATE

Rel. No. 83-19

Pioneer 10 Background

To editors: Pioneer 10 will be beyond all the known planets on June 13, 1983 at 5 a.m., PDT, the first such flight in human history.

Pioneer now has piled up a number of accomplishments.

Descriptions of times, distances, performance, and other circumstances of the spacecraft and its operating system also are striking, and are listed here.

Pioneer is operated and managed by NASA's Ames Research Center, Mountain View, CA. The spacecraft was built by TRW Space and Communications Group, Redondo Beach, CA. Tracking and data return is by NASA's Deep Space Network.

Unusual Circumstances

1) Pioneer will pass beyond the outermost planet at a speed of 30,558 mph. This is almost a million miles per day, around a third of a billion miles per year.

2) Pioneer carries the longest-distance letter ever sent, the plaque designed by Carl Sagan, showing a man and a woman, location of the solar system and other information. This "letter" to beings who might find the spacecraft has so far traveled 3.5 billion miles.

3) NASA hopes to track Pioneer 10 with the Deep Space Network (DSN) radio receivers for another ten years, out beyond five billion miles, 2.2 billion miles beyond the spacecraft's present distance.

4) Round-trip "light time" for Pioneer's 2.8 billion mile communications is now 8 hours and 40 minutes. This means that commands sent when controllers get to work are answered by Pioneer at quitting time.

5) Pioneer sends its information with an eight-watt radio transmitter, which has a power equivalent to that of a Christmas tree light. When it is received by the 210-foot-diameter radio antennas of the DSN, the original eight-watt signal has weakened to one billion-trillionths of a watt (.000,000,000,000,000,001 watt).

6) If the signal from the spacecraft could be collected and stored with one of the DSN radio dishes for 67 million years, the total energy collected would not be enough to power a seven-and-a-half-watt light bulb for even one-thousandth of a second.

7) That such a tiny signal is detectable at all is a tribute to the tremendous increases in receiver sensitivity achieved by the Deep Space Network since the spacecraft's launch in 1972.

8) Pioneer uses a nine-foot, parabolic radio dish to focus the radio signal into a narrow, degree-and-a half wide, conical beam. Despite such a "tight" beam, by the time the signal has covered the 2.8 billion miles to Earth, it has spread over an area more than eleven million miles across.

9) Because the orbit of Pluto, normally the outermost planet, is such a stretched-out oval, Pluto will be inside Neptune's orbit for the next 17 years. It will be close to Neptune's orbit for the next 50 years. By 2050, Pluto will be far outside Neptune's orbit, as well as high above the plane of the other planets. Pluto and its newly-discovered moon Charon, take 250 years to complete a trip around the Sun.

10) Pioneer's basic mission was for a 21-month trip to Jupiter. However, by now the rugged spacecraft has lasted 11 years, and may well last another ten years.

11) Because sunlight beyond Mars is too weak to power solar cells, the spacecraft uses a radioisotope power supply, which may well run it for 21 years.

12) Currently, Pioneer is exploring the outer solar atmosphere.

13) It is also looking for a tenth planet or dark star, and for evidence of universe-shaking collisions, in the form of gravity waves. These would have wave-lengths of one to three billion miles.

14) At the long-lived spacecraft's current distance (2.8 billion miles), the Earth would be seen as a pin point of light, never more than 2.2° away from a Sun still intensely bright (20 times brighter than the Moon), but no larger than a pin head.

15) Over the next 850,000 years, Pioneer's closest approach to any star system probably will be to the star, Ross 248. This will take place 32,610 years from now, with passage at 3.27 light years from the star (a big distance). Star trajectories are not well-known, and beyond 850,000 years, closer approaches may well occur. At typical star-separation distances, Pioneer might expect a relatively close approach to a star system on an average of once every million years.

16) Since launch in 1972, Pioneer 10 has operated almost without flaw. By June 13, 1983, Pioneer 10 will have traveled 3.59 billion miles on its flight path, will have received over 98,900 commands from Earth, and transmitted more than 126 billion bits of scientific data.

Firsts

1) First flight beyond Mars.

2) First trip to Jupiter.

3) First crossing of the Asteroid Belt and finding that it presents little hazard to spacecraft.

5) First passage through Jupiter's tremendously powerful radiation belts (five to ten thousand times as intense as Earth's, with millions of times the energy).

7) First closeup pictures of Jupiter's Great Red Spot and belts and zones showing details of atmosphere circulation.

8) First crossings of the orbits of Uranus, Pluto, and Neptune.

Discoveries

1) Pioneer 10 has found that the heliosphere (the Sun's atmosphere) extends much farther than previously thought. Previously, the heliosphere's boundary, or "heliopause," was believed to lie just beyond Jupiter. But Pioneer 10 is six times that far out and has yet to encounter the boundary.

2) Discovery that Jupiter is a liquid planet.

3) First model of Jupiter's huge, pulsating, magnetosphere (a million times the volume of Earth's).

4) First description of Jupiter's magnetic field.

5) First accurate measurements of mass and densities of Jupiter's planet-sized moons, key to the planet's formation history.

6) Proof of origin of the gegenschein and zodiacal light (reflections of interplanetary dust near the Sun and inner planets).

7) The heliosphere (the magnetic bubble formed by the solar wind, containing the solar system) appears to "breathe" in and out once every 11-year solar cycle.

8) The shock waves of the enormous storms on the Sun seem to persist in the heliosphere for as long as a year, probably changing the heliosphere bubble's shape, as if it were a huge pulsating jelly fish.

9) The solar wind was expected to slow with distance from the Sun, but this has not happened. Almost no motion energy has been lost as heat.

10) As the solar wind thins out going away from the Sun, scientists expected to find many more cosmic ray particles penetrating the protective solar atmosphere. This has not happenned so far.

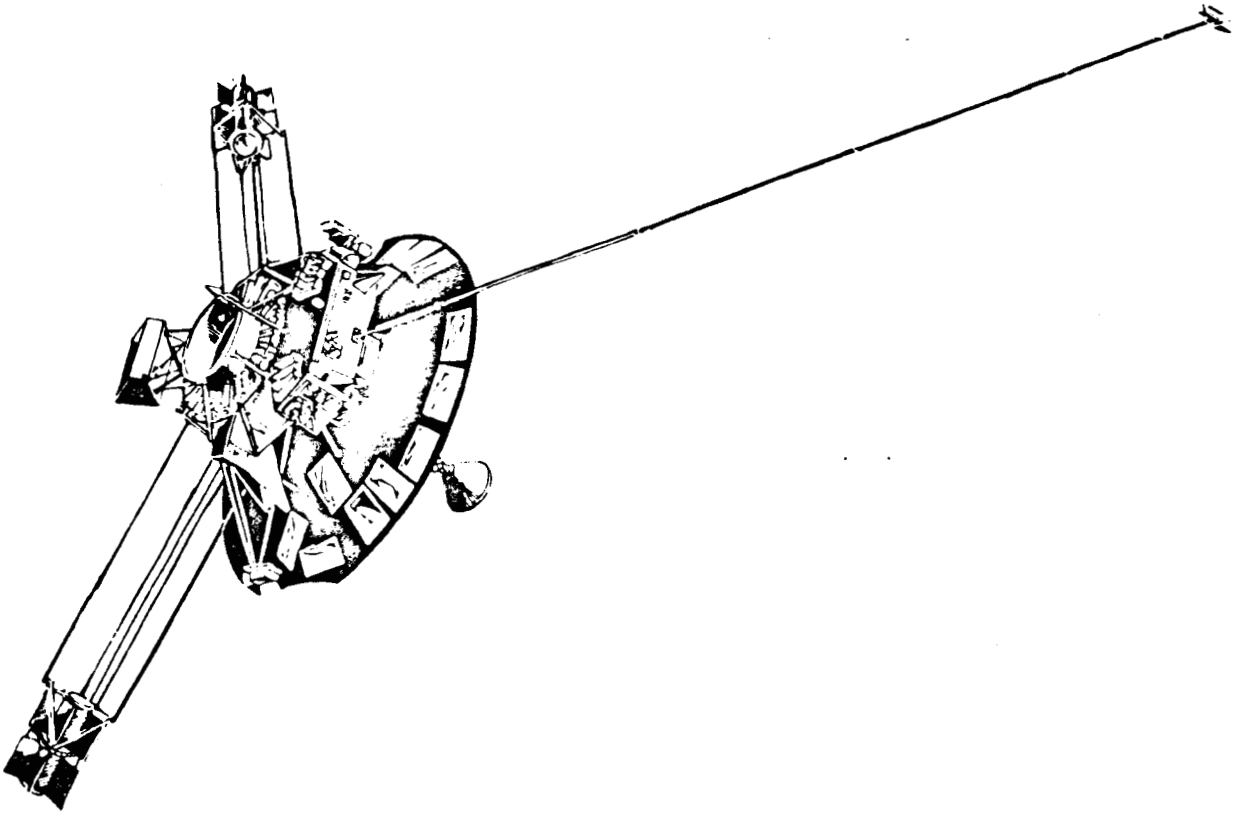
11) The primary source of turbulence in the outer heliosphere is storms on the Sun, not solar wind collisions, as in the inner solar system.

12) Near solar maximimum, cosmic ray particles incoming from the galaxy in all velocity ranges (even near light speed) become half as numerous or are shut out completely from the heliosphere.

13) For unexplained reasons, high velocity streams of electrons from Jupiter moving through the heliosphere don't wobble as expected from the planet's axial tilt.

14) The heliosphere is bisected by a 'flapping' current sheet, aligned with the Sun's equator, and believed to extend to the interstellar boundary.

15) As solar storm activity builds up, the heliosphere is believed to deform into a more oval shape lined up with the Sun's equator, from its rounder shape at solar minimum. It also may expand in size.

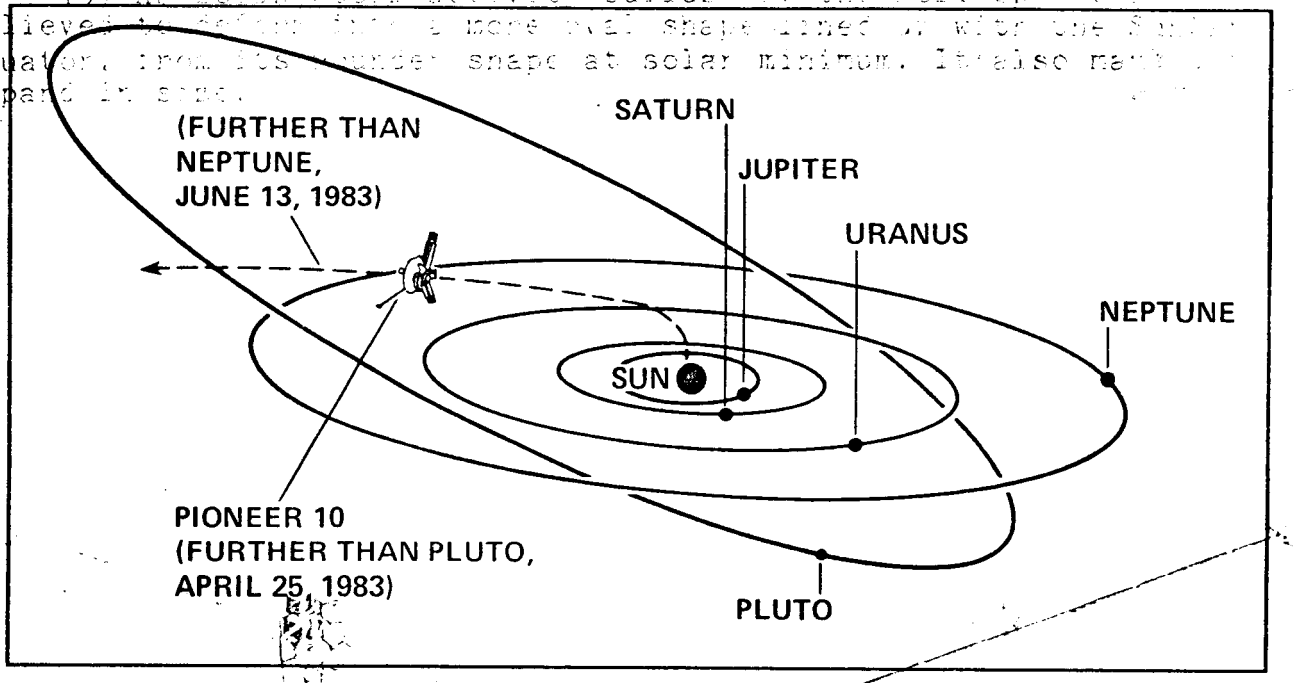


13. For unexplained reasons, high velocity streams of electrons from Jupiter moving through the heliosphere don't wobble as expected from the planet's axial tilt.

14. The heliosphere is bisected by a 'flapping' current sheet, aligned with the Sun's equator, and believed to extend to the interstellar boundary.

15) As solar storm activity builds up, the heliosphere is believed to become first more oval shaped aligned with the Sun's equator, from its rounder shape at solar minimum. It also may expand in size.

PIONEER EXIT FROM SOLAR SYSTEM



Because Pluto will be inside Neptune's orbit for the next 17 years, the current limit of the solar system (distance of the outermost planet from the Sun) is at Neptune's orbit. Since Pluto takes 250 years to circle the Sun, it will be relatively close to Neptune's orbit for the next 50 to 75 years, long after Pioneer has departed into interstellar space.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

6/83

For Release

Peter Waller 415-965-5091 IMMEDIATE

John Gustafson

Rel. No. 83-20

To editors: A number of events are planned at several places in the country to mark the passage of Pioneer 10 beyond the known planets. This schedule of these events is for your information.

Schedule of Events for Pioneer Solar System Exit

Thursday, June 9; Friday, June 10; Monday, June 13

(Some items still subject to change)

NASA News

Ames Research Center

Schedule

Peter Weller 415-965-5[illegible] IMMEDIATE

Joni Guastaferro

Ref. No.

Thursday, June 9, 1983

10 a.m. CDT--Briefing at University of Chicago for Chicago and mid-west news media.

Participants: Drs. John Simpson, Bruce McKibben, other Pioneer experimenters.

Information: Larry Arbeiter, University News Office 312-962-8358

Friday, June 10, 1983

11 a.m. PDT--News Conference covering NASA-Ames Pioneer ceremony and advance on events of Monday, June 13.

Participants:	Guastaferro	Fimmel
	Hall	Van Allen
	Dyal	Simpson

12:30-1:30 p.m. PDT--Visits by news media to Pioneer Control Center.

2 p.m. PDT--Ames Research Center Solar System Exit ceremony-symposium (Program available)

Participants:

Richard Fimmel, project manager

C. A. Syvertson, Ames Director

Charles Hall, project manager (retired)

Carl Degler, Pulitzer prize-winning historian, Professor, Stanford University

James Van Allen, Pioneer experimenter, Professor University of Iowa, discoverer of Van Allen belts

John Simpson, Pioneer experimenter, Professor, University of Chicago, former head of Fermi Institute, Chicago

Eric Burgess, author, co-founder, British Interplanetary Society

3 p.m. PDT--Panel discussion, chaired by Eric Burgess, including above participants, plus Dr. Nicholas Renzetti, manger, Deep Space Network.

4:30 p.m. PDT--Refreshments, Ames Cafeteria

(Above events available to news media; ceremony and panel to be televised in hour special scheduled on PBS stations, nationally; Channels 9, 32, 54, and 60 in the Bay Area.)

Guests: Pioneer people and Ames officials, academic, scientific, and local guests, VIPs, Congressmen, news media.

Location: Ames main auditorium and Ames Cafeteria

Monday, June 13

4:30 a.m. PDT--Major event, Pioneer Operations Center Arrangements for news media, especially network morning shows.

5:00 a.m. PDT--Neptune orbit crossing

a) Telemetry and science data
b) Picture by Arizona from 2.8 billion miles
c) Crossing orbit on Control Center display
d) Second display shows galaxy and Pioneer star travel.
e) Other items as in Pluto crossing. Possible Neptune trident, coffee and rolls or other early morning fare.
f) Celebration by spacecraft controllers, officials.

7:00 a.m. PDT (10 a.m. EDT)--White House ceremony or other Presidential recognition (tentative)

9:00 a.m. PDT--News reporters arrive at Ames, go to Control Center

9:20 a.m. PDT--Real signal reaches Control Center, second celebration of sorts.

Information and visuals for 5 a.m. event, also available at 9:20 a.m.

10:00 a.m. PDT--News briefing re event and significance

Participants: Dyer Colin
Ballhaus other to be chosen

10:00 a.m. PDT--TRW News Briefing re Pioneer 10, Redondo Beach, CA; TRW officials and project people Pioneer signal piped in from Ames.

11:00 a.m. PDT (2 p.m. EDT)--Congressional space caucus ceremony (tentative)

4:30 p.m. PDT (7:30 p.m. EDT)--Smithsonian reception

Attendees: Congress, NASA, OMB, industry, DOD, news media, other notables.

Spacecraft signal piped in from Ames.

7:30 p.m. PDT--TRW, Redondo Beach, evening reception for spacecraft builder project people and others

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter Waller 415 965-5091

IMMEDIATE

No. 83-30

Balloon Drop Test for Jupiter Atmosphere Entry Spacecraft

A high-altitude balloon-drop test of the Galileo Atmosphere Probe spacecraft, which will make the first descent into the atmosphere of Jupiter, is scheduled for no earlier than Wednesday, July 20, at White Sands Missile Range, New Mexico.

The Galileo spacecraft will be launched to Jupiter in mid-1986. It consists of an orbiter and atmosphere probe, and will reach the planet in late 1988. The probe craft will separate from the parent spacecraft 150 days before arrival at Jupiter, and will fly 200 miles down into the atmosphere of the giant planet, penetrating below the swirling clouds to a pressure level 20 times higher than that on the Earth's surface. Data obtained during the descent of the probe will be transmitted to the overflying orbiter, which will relay the information to Earth. This will be the first direct sampling of the atmosphere of any

of any outer planet. Scientists are extremely curious about the composition of Jupiter's atmosphere, and the dynamics of its clouds. This data will tell about the evolution of the solar system, our weather on Earth, and about giant Jupiter itself.

At the test drop altitude, the spacecraft (consisting of the Galileo Deceleration Module and the Descent Module) will separate from the balloon. As it drops, it will experience dynamic pressure and deceleration forces virtually identical to those it is expected to encounter in Jupiter's atmosphere. Purpose of the high-altitude test will be to demonstrate the Galileo parachute deployment sequence, and separation of Deceleration Module from the Descent Module.

The balloon drop will be made from about 100,000 feet above the Earth (19 miles) The polyethylene balloon has a 5.14 million cubic foot capacity. Air Force technicians will launch the balloon from Roswell, N. M. After launch, the balloon is expected to float 120 miles westward over the Army's White Sands Missile Range, where telescopes and cameras will record the Galileo probe deployment and separation. Telemetry will monitor key mission events.

During the test, the probe craft will duplicate the flight sequence at Jupiter. A small pilot chute separates the aft cover from the Deceleration Module, and extracts the large main parachute. The rest of the Deceleration Module (heat shield and aeroshell structure) then separates from the Descent Module, which completes the flight, descending on the parachute.

The Descent Module will carry instrumentation to monitor

various mission events and performance. It will also radio data to the ground, carry a programmer to initiate various events, plus cameras, batteries for power, a radio beacon for ground recovery, heaters and thermostats for temperature control.

The balloon will carry a recoverable gondola to house the Galileo probe hardware, and provide pre-drop power, heating, movie cameras to record the drop, and other balloon-related equipment.

Balloon filling with helium gas at Roswell, N.M. is expected to take one to two hours, with release at about sunrise. The ascent and subsequent 120 mile flight downrange to the drop zone will take from two to eight hours depending on the winds.

Project management for the Galileo probe system is by NASA's Ames Research Center, Mountain View, CA. Hughes Aircraft Co., El Segundo, CA is the prime system contractor responsible for design and development of the spacecraft. General Electric Co., Philadelphia, is providing the forward and aft heat-shields and deceleration structure system, including parachutes. Launch operations and range operations coordination are provided by the Air Force Geophysics Laboratory. Overall Galileo Project Manager is NASA's Jet Propulsion Laboratory, Pasadena, CA.

- end -

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

X 8/83

For Release

Darlene Jenkins-Peterson: A summer intern at Ames from the University of California, Santa Cruz.

IMMEDIATE

Peter Waller 415/965-5091

Release No. 83-36

NASA'S Teacher "Summer School" Blasts Off Again

Between June and August, they construct and launch rockets at Moffett Field, California, peer through microscopes at lunar rocks in Houston, Texas, or analyze space communication in Cleveland, Ohio. Come September, they are back in their classrooms illustrating aeronautical principles on the chalkboard to eager elementary or high school students.

While other vacationers backpack the Sierra or laze poolside this summer, more than 7000 teachers from nearly every state have chosen to study aerospace science and research at NASA space centers and Universities across the nation. During the past few years, teachers have become the students and space research centers like NASA's Johnson, Lewis, and Ames the classrooms--classrooms which house Shuttle flight simulators or hypogravity apparatus inside and one of the world's largest wind tunnels or U-2 high altitude planes outside.

In one concentrated week of activity, teachers see first hand NASA's research in aeronautics, space biology, astrophysics, and astronomy. They tour the labs, talk with the experts, and acquaint themselves with the technology. Back in their classrooms, they will funnel their discoveries into lessons for their students this fall.

Despite such unexpected events as the arrival of a local fire and police department during "hands-on" rocketry demonstrations, hard beds in unfamiliar dormitories, and temporary difficulties with NASA acronyms, participating teachers say they are happy with the experience.

It's all a part of the space science summer program sponsored by NASA's Education Offices in cooperation with several universities and the U.S. Air Force Civil Air Patrol.

James Poindexter, Educational Officer at Johnson Space Flight Center in Houston, underlined the workshops' purpose: "We feel it is important to get information out to the teachers, but what makes our programs truly effective is encouraging teachers to incorporate up-dated, accurate aeronautical and space flight information into their curriculum."

Sample space science exercises designed in the workshop range from using the names of Saturn's moons for elementary word puzzles to classifying meteorites by mineral composition or graphing a miniature parachute's rate of descent. Other lessons on solar energy, or designing hypothetical governments for Mars, address environmental, social science, and political issues.

One recent example of NASA's summer program is the aerospace teacher workshop at Ames Research Center, Mountain View, Calif. Called "Space Down to Earth," the popular workshop entered its fourth summer the first week in August.

Educators, largely teacher-school administrator teams, participated in the workshop co-sponsored by San Jose State University and the Civil Air Patrol. The roster showed over 40 participants representing elementary and secondary schools from California and the Pacific Northwest.

"I was dazzled by NASA's hardware and mind-boggling technology," said "Bud" Smith, a past participant and an elementary school teacher from Carmel Valley, Calif. "It was all very exciting to see and a great motivation to us teachers to present more science in our classroom," said Smith.

The hardware and technology varies from one space reseach center to another. Ames offers a look at cockpit simulators used to train shuttle pilots; cameras that can capture crop conditions from altitudes of 65,000 ft; biomedical instruments that bleep out information on the physical state of astronauts; or the large-bellied modified transport aircraft, dubbed the Kuiper Airborne Observatory, which carries astronomers, an infrared telescope, computers and crew into a vantage point well above most atmospheric interference.

One valuable aspect of the summer program is the contact the teachers have with the scientists and engineers working at NASA. "Talking with the experts in the field, hearing from the people doing the work is a key to the workshop's success. The

people at the laboratory bench or flying the planes just have something special to offer that can't be translated indirectly," said Garth Hull, Educational Programs Officer at Ames.

Throughout the week, over a dozen Ames researchers, technicians, and engineers described the purpose and procedures of their work. The teachers directed varied questions to the experts on such topics as space sickness, UFO's, and animal care on Space Lab.

Two high school students from Salt Lake City emerged as key speakers at the workshop when they described the seed germination experiment they designed for one of the Space Shuttle's coming flights. The boys developed the apparatus and procedure to photograph various seeds' development in the Shuttle's weightless environment--meeting NASA's size limitaions of a 2.5. cubic foot container and only three on/off, astronaut-assisted controls.

Different workshop activities impressed each participant. Seeing Jupiter through the 36-inch telescope at nearby UC Santa Cruz's James Lick Observatory was a "once in a life-time opportunity" for Joe D'Andrea of Yuba City, Calif., "even if we didn't get home until two in the morning."

A third grade teacher recognized the complicated network of support personnel required for any space exploration program, and decided to include a space careers unit in her class this year.

Nancy Keesee built a model rocket and fired it off--a new experience for the elementary school teacher. "Just putting it together was a learning experience in itself," she said. But after the group discussed propellants, rocket engines, drag

factors and measured the rockets altitude and velocity during flight, Nancy appreciated the exercise even more. "What a great hands-on lesson incorporating math, physics, and astronomy," she said.

Benefits from NASA's workshops begin with motivated teachers, and typically diffuse into school departments, entire schools, or occasionally a school district. For example, Kern County Unified School District in Southern California, sent teachers to last year's "Space Down to Earth," and now has aerospace resource centers in its school libraries, a space science county curriculum center, and frequently features NASA personnel in its own teacher conferences.

Participants leave NASA's summer aerospace workshops with a bundle of notes, pamphlets, information guides and booklets. But perhaps the teacher's most valuable resource from NASA is a rekindled enthusiasm for creative teaching in math and science.

Watch closely this fall and see if Susie is learning her geometry by setting off rockets....

8/83

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Evvie Rasmussen 415-965-5091

Darlene Jenkins-Peterson

Release No. 83-37

For Release:

IMMEDIATE

EXERCISE AND DIET MAY CONTROL BLOOD CHANGES DURING WEIGHTLESSNESS

NASA Ames Research Center scientists have found that exercise coupled with a low-calorie diet might counteract the effects of weightlessness on insulin and glucose levels in the blood of space travelers.

Ames biomedical researcher Dr. Constantine Dolkas and Dr. Carl Mondon of the Veteran's Administration Medical Center in Palo Alto have shown that plasma insulin and glucose increase during simulated weightlessness, but return to normal levels after exercise.

The researchers simulated the effects of weightlessness by subjecting volunteers to one or two weeks of complete bed rest. Prolonged bed rest, with the body in a constant supine position, closely approximates the physiological responses to true weightlessness.

Toward the end of the bed rest periods, the volunteer's use of blood sugar and level of plasma insulin were checked. Dolkas and Mondon evaluated each subject's sugar uptake with a glucose

(more)

tolerance test, studying the concentration of glucose in their blood for three hours following consumption of a sweet drink. Results showed prolonged bed rest without exercise decreases some cell's ability to use glucose. Thus, increased levels of the sugar remain in the bloodstream. After bed rest without exercise, the average blood sugar level of the volunteers rose over 10 percent above normal, closely resembling a temporary, prediabetic state.

Dolkas and Mondon found especially high concentrations of insulin in the blood after complete bed rest. More than a 200 percent rise in blood insulin occurred in subjects exposed to prolonged bed rest without exercise. The excessive insulin apparently results from the body maintaining a normal production of the hormone, but using it less. Dolkas and Mondon called this response "insulin resistance" and found muscle cells especially insulin resistant following bed rest. The researchers suspect the same reaction would be found in astronauts exposed to the weightlessness of space.

Insulin is a pancreatic hormone secreted into the bloodstream to catalyze the storage of plasma glucose in liver and muscle cells. Storing the glucose within these cells permits a ready reservoir of energy for the body. The Ames study indicates that after prolonged bed rest sufficient insulin circulates in the blood, but insulin seems less proficient in controlling glucose storage in cells. Excess glucose then accumulates in the blood along with the insulin.

Sustained high levels of blood sugar can lead to serious

health problems. The body converts excess glucose in the blood into stored fat molecules, called triglycerides. High concentrations of triglycerides can clog blood vessels and lead to atherosclerosis, or "hardening of the arteries." An astronaut exposed to prolonged weightlessness, showing insulin resistance and increased blood sugar, might also accumulate triglycerides. Without any countermeasures, extended flights in space might enhance susceptibility to circulatory and heart problems.

Fortunately, there are strategies available to space travelers which counteract insulin resistance and glucose imbalances. Dolkas and Mondon found exercise and a reduced-calorie diet to be simple, effective solutions. Exercise typically depletes blood sugar as energy is needed and slows down the pancreatic production of insulin as well. A low-calorie diet prevents excess glucose and triglyceride accumulation in the blood.

Additional studies by Dolkas and Mondon suggest that the beneficial effects of exercise on insulin resistance and glucose levels might be maintained for a number of days after exercise stops, as long as a low-calorie diet is consumed. This prolonged effect of exercise would make physical activity less critical during any short flights in space.

Dolkas presented three possible explanations for the insulin resistance and increased blood sugar following bed rest and, by analogy, weightlessness. One hypothesis suggests a malfunction at insulin "receptor sites" on liver or muscle cells. These receptor sites normally bind with insulin and permit the hormone

to act upon plasma glucose. Faulty reactor sites could lead to insufficient binding of insulin to muscle cell membranes, causing higher levels of both insulin and glucose in the blood.

Likewise, bed rest or weightlessness might increase the activity of some hormone working in opposition to insulin. With blood sugar then accumulating, the pancreas would secrete more insulin, but insulin's activity never quite balances that of the antagonistic hormone. Finally, insulin resistance might result from the pancreas producing an abnormal and less active form of insulin.

Dolkas and other Ames researchers hope to identify the exact mechanism causing insulin resistance in muscle cells during bed rest and/or weightlessness. A better understanding of blood sugar and insulin activity during weightlessness and exercise may also offer a clearer chemical picture of the blood sugar imbalances of diabetics and hypoglycemics.

#####

August 25, 1983

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

9/8 3

Peter Waller (415) 965-5091

For Release

Release No. 83-38

IMMEDIATE

AMES ROLE IN NASA'S
FIRST 25 YEARS

On October 1, 1983, the National Aeronautics and Space Administration will be 25 years old.

During the agency's first quarter century, 12 astronauts walked on the Moon and dozens of astronauts and scientists have worked in low earth orbit. The planets Mercury, Venus, Mars, Jupiter, and Saturn have been explored. The launching of communications satellites allows us to see events anywhere on Earth. Applications of NASA work have built industries, created jobs, and enriched human life.

During these 25 years, NASA-Ames played a significant role. The understanding needed for NASA accomplishments has often come from Ames scientists and engineers, and from Ames special skills.

During the period, Ames research has evolved into three major capabilities: aeronautics and aircraft flight testing,

space sciences and space exploration, and life sciences. Ames aeronautics has developed the full range of major tools in a single research center: computational analysis of proposed designs (supercomputers), wind tunnel testing, flight simulation of aircraft handling qualities, and advanced flight testing at the Dryden Flight Research Facility.

Space science organizations have helped explore Jupiter, Saturn, and Venus. They have developed capabilities in astronomy, planetology, planetary atmosphere research, and the basic physics and chemistry of flight and related work.

Life sciences has made advances in human factors and biomedical research for both space and aircraft flight--as well as in planetary life detection and evolution of life on Earth and potentially elsewhere in the universe.

Along with other NASA groups, the Center made important contributions to the Mercury, Gemini, and Apollo programs, which achieved the moon landing. Ames skills in atmosphere entry systems and entry heating were important in design of all three vehicles. Ames also contributed to aerodynamic design and flight profiles for these craft.

Lifting body research began at Ames. Since the shuttle is in many respects a lifting body, the Center contributed to design and development of the shuttle from the beginning. Ames wind tunnels and people provided support for shuttle aerodynamics and entry. We had a major part in the shuttle thermal protection system. The Ames Dryden facility at Edwards, CA handled shuttle landing tests, and is providing essential support for shuttle landing operations.

Ames also contributed importantly to guidance, pilot-handling, avionics, materials, and human factors systems for the Moon program vehicles, as well as for shuttle.

Over a quarter century the Center has made advances in very diverse areas. Scientists found the amino acids which make up living systems in the Murchison meteorite believed to have come from the Asteroid Belt. An Ames paper predicted vulcanism on Jupiter's moon, Io, before the Voyager pictures confirmed that Io is the most active volcanic body in the solar system.

The Center pioneered computational fluid dynamics, both with hardware (the Illiac super computer) and computational techniques for three-dimensional fluid (air) flow. We developed new aircraft designs, such as the radical scissor-like oblique wing, and the technically-difficult tilt rotor. The tilt rotor is a completely new kind of flight vehicle, providing vertical lift combined with long-distance, high-speed flight.

Due to Venus atmosphere work and years of work in entry heating problems (dependent on atmosphere characteristics), Ames has developed a general expertise in planetary atmosphere research.

Ames has established means of encouraging individual research accomplishements, such as educational grants and the H. Julien Allen award, named for the second Center Director.

The Pioneer spacecraft made the first trips through the Asteroid Belt and to Jupiter and Saturn. Last June, Pioneer 10 completed history's first flight beyond the planets. These

spacecraft carried what James Van Allen has called a "classic array of experiments". They made a very large number of discoveries about Jupiter and Saturn, the Asteroid Belt and the interplanetary medium.

In addition to the outer planet Pioneers, the six vehicles of the Pioneer Venus program made far more intensive explorations of Venus than ever before. The Venus Pioneers photographed the planet for a year. They measured Venus's clouds and atmosphere from top to bottom in both day and night hemispheres. They provided the first topographical map of the planet, giving us our first look at Venusian mountains, "continents", lowlands, and "seas". The Venus Orbiter continues to circle Earth's cloud-draped twin planet.

Ames 30 wind tunnels include the world's largest and span speed regimes from below 100 mph to many times the speed of sound. Added to this, the Dryden Flight Research Facility possesses a range of unique research aircraft and flight research equipment. Virtually every high performance U. S. aircraft in the past 25 years has been tested at Dryden.

Ames researchers have pioneered research in jet-powered VTOL craft and in prop-jet transports, the next generation of fuel efficient aircraft. The QSRA, a quiet short takeoff and landing transport aircraft design holds promise for short haul aeronautics using small airports.

Our flight simulators, particularly the multi-story motion-generating machines for these huge devices are unique and allow "flight testing" during design of air and spacecraft.

With its U-2 aircraft, the Galileo II observatory aircraft,

and the Kuiper Airborne Observatory, the Center has progressed in airborne science. These studies range from airborne surveys of crops on Earth for weed control to observations of the galactic center and new star formations in the Orion nebula. Especially noteworthy was the Kuiper's discovery of rings around the planet Uranus and U-2 observations of remnant radiation from the universe-creating "big bang."

Ames and Dryden currently have around 2000 employees, and almost 1400 contractor employees work at the two locations. Since 1958, the Center has added many new facilities and some 300 acres of land between its original site and San Francisco Bay. It has developed a master plan for future growth in the new area.

During the past 25 years, Center contributions to aeronautics, astronautics, and life sciences have included extensive activities not included in these brief examples.

Highlights for the future include: planned developments in short haul aeronautics; fuel efficient and advanced high performance aircraft; and progress in applications of super computers to aircraft, spacecraft, computational chemistry, and weather research. Also planned are biological research aboard the shuttle; further studies of planetary atmospheres, including the Earth's; the first direct measurements of Jupiter's atmosphere; attempts to identify planets around other stars; and work toward a U. S. space station.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

For Release

IMMEDIATE

Rel. No. 83-40

To Editors:

At 8 a.m. PST, Wednesday, Nov. 9, many of the findings of the IRAS infrared telescope will be made known at a Washington news briefing.

The briefing will be piped in to NASA-Ames (audio and video), and Bay Area reporters can transmit questions to speakers in Washington. Seven astronomers plus various officials will make a two-hour presentation of results.

The IRAS telescope is a Bay Area project in that its development was managed by NASA-Ames. The telescope was launched last January from Vandenberg AFB, and has been very successful.

Since IRAS is the first infrared telescope in space, and is making the first whole-sky survey in the infrared, the new results are expected to be impressive. Most infrared light is blocked out by the Earth's atmosphere, so few infrared observations have been made to now. Cool objects (like planets) radiate most of their energy in the infrared, and such objects are among the most interesting in the heavens. IRAS is expected to find 400,000 new infrared sources.

IRAS findings, little reported but already released, include: a possible planetary system around Vega, various centers of new star formation, two colliding galaxies, a star expanded to solar system size, a "monster" star in the large Magellanic Cloud, and five new comets.

For television, there will be models of the IRAS telescope, as well as several large color paintings. Ames infrared astronomers will be there to comment.

Newsmen planning to attend should come to the NASA gate of Moffett Field (gate 18) from where they will be directed to the Space Sciences Auditorium (bldg. 245).

11/4/83

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Evvie Rasmussen 415-965-5091

For Release

Release No. 83-43

IMMEDIATE

AMES RESEARCHERS LINK BRAIN CHEMICALS TO SPACE MOTION SICKNESS

For years researchers have searched in vain for a direct link between the vestibular system -- the body's balancing mechanism located in the inner ear -- and vomiting centers in the brain.

Now researchers think they may have found that link -- not through the neural connections of the central nervous system, as expected, but through the chemical components of cerebrospinal fluid.

NASA scientists studying motion sickness at Ames Research Center are on the trail of a chemical substance in the fluid core of the brain which may cause vomiting. The possibility that there may be a chemical link in motion sickness was discovered through NASA's research into the basic causes of space motion sickness. This basic research is being conducted both at Ames and at NASA's Johnson Space Center in Houston, Texas.

(more)

November 14, 1983

Ames scientist Dr. Nancy Daunton and two colleagues at Wright State University in Dayton, Ohio -- Dr. George Crampton and Dr. James Lucot -- are tracking a chemical they believe may be secreted into cerebrospinal fluid to cause vomiting during motion sickness.

Their studies have shown that blocking the flow of cerebrospinal fluid in the brain stops motion-induced vomiting, and that an incomplete block does not suppress vomiting -- findings which strengthen the hypothesis. The scientists are now attempting to isolate the responsible chemical from cerebrospinal fluid.

Space motion sickness has afflicted about 50 percent of astronauts and cosmonauts exposed to weightlessness. Sickness occurs during the first few days in zero gravity, with some symptoms which resemble those experienced on a boat or plane -- disorientation, malaise, nausea and sometimes vomiting. The symptoms are aggravated if the astronaut performs tasks involving head movements or moves about in a large work space.

Scientists agree that the vestibular system plays a critical role in motion sickness. The inner ear contains vestibular structures -- semicircular canals that sense angular acceleration and otolith organs that sense linear acceleration and gravity.

These vestibular organs, along with muscle receptors and vision, provide sensory input to the central nervous system for control of posture and eye movement and for perception of self-

motion and orientation. Abnormal vestibular inputs in weightlessness may be one factor leading to space motion sickness.

When a person receives sensory cues for motion, the brain responds with its normal, programmed responses to control eye, head and body movements. But when the responses do not yield the expected results -- especially when the visual image does not stabilize and postural control is not easily maintained -- humans and animals often experience motion sickness.

All of Daunton's research is directed toward understanding the basic mechanisms triggering motion sickness. Her studies are conducted under the Ames Biomedical Research Division which is responsible, along with Johnson's Space Biomedical Institute, for the study of physiological responses to weightlessness for the NASA Life Sciences program.

####

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller (415) 965-5091

IMMEDIATE

Margaret Scheitrum

RELEASE NO. 83-48

NEW EVIDENCE FOR HUGE VOLCANOES ON VENUS

Scientists believe a massive volcanic eruption -- dwarfing the largest Earth eruptions - - recently occurred on Venus. This adds to the growing body of evidence for gigantic active volcanoes on Earth's twin planet.

A variety of major findings by the Pioneer Venus spacecraft in orbit around the cloud-draped planet point to this huge scale volcanism -- volcanoes far larger than those on Earth.

• A new analysis covering five years of findings by the Pionner orbiter indicates that concentrations of sulfur dioxide in Venus' atmosphere increased more than 50 times in 1978 and have been declining steadily ever since. These findings were made by Dr. Larry Esposito of the University of Colorado, Boulder. They point to a very large volcanic eruption, he says. A major increase in atmospheric sulfur dioxide normally occurs after volcanic eruptions on Earth as well.

• Earlier Pioneer topographic maps covering most of the planet indicate the mountainous regions of Beta Regio and Atla Regio (in the Scorption Tail of Aphrodite Terra) are of the proper size and shape for giant volcanoes. Detailed analyses of Pioneer gravity sensing data also have shown that these two areas are unique in being formed from new rock, recently extruded from Venus' interior.

Remarkably -- repeated clusters of lightning bolts, very similar to lightning discharges generated in terrestrial volcanic plumes, also have been discovered by Pioneer investigator, Dr. Fred Scarf of TRW, Inc., Redondo Beach, CA. The lightning discharges are detected by Scarf's plasma wave instrument aboard the Pioneer Venus orbiter. A multitude of lightning events have been recorded directly above the surface of Beta and Atla Regio. These events are believed to be tied to the volcanic mechanism.

Esposito's Venus atmosphere findings also depend on data from the four spacecraft of the Pioneer multiprobe, which has measured Venus' atmosphere from top to bottom planet-wide. The Pioneer Project is managed by NASA Ames Research Center, Mountain View, California.

Beta and Atla Regio are the freshest-looking volcanic sites on Venus based on topography, gravity sensing data and radar altimetry images, according to Dr. Harold Masursky, of the US Geological Survey, Flagstaff, Arizona.

Beta Regio has been interpreted as consisting of two enormous shield volcanoes, almost 1300 miles in length, larger

than the entire Hawaii Midway chain. This area appears to be the most volcanically active region on the planet. Images from Pioneer Venus and ground-based radar show radiating bright rays on Beta, indicative of very young lava flows. Measurements of volcanic basalts by a Russian lander spacecraft also support this.

Beta is believed to sit over a powerful upflowing convective plume, deep in Venus' interior magma. Huge by any standards, Masursky believes the volcanoes on Beta may dwarf all other solar system volcanoes in volume, including Olympus Mons on Mars, currently the highest volcano in the solar system (three times higher than Beta.)

Recent Earth-based radar images show indications that Maxwell Montes is a huge ancient dead volcano. Maxwell is the highest point yet found on Venus, a mountain massif higher than Everest. It shows none of the signs of recent activity recorded for Beta and Atla.

The apparent huge volcanoes seem to be related to the planet's global heat balance. Although Venus appears to have the same internal heat sources as the Earth, Earth is able to vent its heat at many points, especially at the constantly expanding mid-ocean ridges. Scientists believe Venus, unlike the Earth, has no mobile plate tectonics and hence, no mid-ocean spreading regions where the crust is forced apart and liquid magma emerges almost continuously.

The huge volcanic outpourtings of Beta and Atla are considered the planet's youngest form of heat escape. Upwelling plumes or "hot spots" in Venus' internal magma are proposed to have burned their way through the thick, rigid crust, venting most of the planet's internal heat at just two places, and creating giant volcanoes. A very similar process formed the Earth's Hawaiian Islands.

The new findings are exciting since the physical characteristics of Earth and Venus are almost identical. Venus has been termed "Earth's Twin" because of the planets' similarity in size, mass, gravity and distance from the sun. This data from another Earth-like planet has immediate practical applications to understanding Earth's geology. It will also help us know more about the evolution of Earth.

Esposito believes a major volcanic eruption occurred on Venus sometime around 1978, accounting for the abnormally high amounts of sulfur dioxide found in the Venusian atmosphere at that time. The eruption forced huge amounts of sulfur dioxide and small haze particles into the atmosphere, sometime shortly before Pioneer Venus began its explorations. The sulfur dioxide in the gas rapidly formed into small aerosol particles of sulfuric acid similar to acid rain on Earth. Pioneer has been recording the slow decay of the volcanic aftereffects ever since.

The unusual increase in sulfur dioxide was also observed by independent ground investigators in 1978. Earlier ground-based observations in the 1950's also detected a similar increase in sulfur dioxide.

Esposito believes the volcanoes were able to blow sulfur up as high as 70 km (40 miles) through the super dense atmosphere of Venus (100 times Earth density). He calculated the eruption as having at least ten times more energy than any volcanoes on Earth in the last 100 years, much larger in magnitude than even such explosions as the famous 1883 eruption of Krakatoa on Indonesia.

Esposito estimates sulfur dioxide levels after the recent eruption of the Mexican volcano, El Chichon, were only ten percent of the 1978 levels detected in the atmosphere of Venus.

Prior to 1978, the upper limit for sulfur dioxide in the Venusian atmosphere was close to two parts per billion. Using ultraviolet spectrometer recordings from instrumentation aboard Pioneer Venus, Esposito found levels of 100 parts per billion. These occurred shortly after the orbiter began circling the planet, and have been tapering off gradually . Esposito reports the sulfur levels are now returning to pre-1978 levels.

Some scientists have reservations, citing such possible alternative mechanisms for the build-up of sulfur dioxide as shifting winds blowing sulfur compounds up from lower atmosphere. However, Esposito believes his data is consistent

with phenomena on Earth.

Esposito's theory is closely analogous to volcanic mechanisms on Earth. After terrestrial volcanoes erupt, large amounts of sulfur-bearing gases, particulary sulfur dioxide, are injected into the atmosphere and dissipate over time. The day after the 1980 eruption of Mount St. Helens, the sulfur dioxide level in the region downwind from the volcano was 2000 times the normal background level.

Are volcanoes active on Venus?

"We have no incontrovertable evidence," says Esposito, "But the data we do have are very persuasive. We can now understand why Venus looked so different in 1978 and we can understand the mechanism which is very similar to phenomena on Earth.

If Venus is volcanically active, Masursky feels it is probably the third most active terrestrial planet, following Earth and the planet-sized satellite of Jupiter, Io.

Esposito feels the question of volcanic activity on Venus will not be resolved entirely until 1988 when NASA plans to map Venus, using imaging radar. The Soviet spacecraft, Venera 15 and 16, are currently mapping Venus, and preliminary data show volcanic cones. The big US radar dish at Arecebo, Puerto Rico has also recorded volcanic cones on Venus. The US mission,

called, "Venus Radar Mapper", will use radar to see through the thick clouds and image the planet's surface. Radar on this spacecraft will have higher resolution and cover five times the surface arear of Russian efforts.

#####

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202 755-8370

25th Anniversary
1958-1983

For Release:
IMMEDIATE

Kenneth Atchison
NASA Headquarters, Washington, D.C.
(Phone: 202/755-3280)

Larry King
Ames Research Center, Moffett Field, Calif.
(Phone: 415/965-5091)

RELEASE NO: 83-96

REPORT RELEASED ON AMES WIND TUNNEL ACCIDENT

Slippage of a mechanical adjustment link has been cited as the "most probable cause" of an accident at Ames Research Center, Mountain View, Calif., Dec. 9, 1982, during test runs of the world's newest and largest wind tunnel.

An investigation board which was formed to investigate the circumstances of the accident released its report today.

The accident, which caused damage estimated in excess of $10 million and a delay of a year or more in the completion of the tunnel facility, resulted in the collapse of a lattice-like structure used to smooth and control the airflow through the tunnel. Debris from the failed structure was pulled through the power section of the facility, severely damaging the fan blades which drive the tunnel. There were no injuries to personnel.

June 10, 1983

- more -

The structure, which failed during a checkout run of the 80 by 120 feet test section at the previously tested speed of 93 m.p.h., is located about 50 feet upstream of the six large electric motors and fans which drive air through either of two test sections, one 40 by 80 feet, and the newly completed 80 by 120 foot test section, the largest in the world.

The vane set structure, which stands 72 feet high and 130 feet wide is composed of 16 horizontal splitter plates and 38 vertical vane assemblies. Each of these vertical assemblies is fitted with an adjustable leading edge. This movable portion is used to guide the airflow through the test section selected for use. For the 40 by 80, the movable vane segment is aligned straight ahead; for the 80 by 120 test section, the movable segment is at an angle of 45-55 degrees.

Adjustable links were installed to provide the fine adjustment between 45 and 55 degrees. The investigation board found that the most probable failure sequence involved the slippage of one or more of the adjustable links, resulting in increased loads in the system and the fracture of a weld joint which in turn led to subsequent failure in adjacent linkage systems, and the partial closing of most of the movable vane segments. With the airflow through the tunnel substantially blocked, the result was an overloading and ultimate collapse of the entire vane set structure.

All of the fan blades in the propulsion system were damaged beyond repair and will be replaced. No other major component of the tunnel, including the motor units themselves, was damaged.

NASA has committed to the redesign and rebuilding of the facility, incorporating the recommendations of the Review Board to improve model testing and diagnostic instrumentation, increase design margins and strengthen project management and test control procedures. The redesign effort is underway and on a schedule which calls for initial facility checkout and testing starting in October 1984 and first research testing starting March 1985.

- end -

NOTE TO EDITORS: Information concerning the Wind Tunnel Accident Investigation Board is available at the newsroom at NASA Headquarters and in the NASA Ames Health and Safety Office.

(Index: 41)

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller 415-965-5091 IMMEDIATE

Rel. No. 84-01

C. A. SYVERTSON RETIRES AS DIRECTOR OF AMES RESEARCH CENTER

C. A. "Sy" Syvertson will retire as Director of NASA's Ames Research Center on January 13 after leading the Center through many of its most productive years.

Syvertson had a major part in the first U. S. research in supersonic and hypersonic flight, both in finding new aerodynamic theory, and in development of hypersonic wind tunnels. He designed the first lifting body (a vehicle for flight from orbit to airfield landing, and the precursor to the Shuttle). He did planning for major NASA missions in both aeronautics and space.

During Syvertson's tenure as Director, Ames merged with NASA'S Dryden Flight Research Center, Edwards, CA. The Center continued advances in powered-lift STOL and VTOL aircraft research. It continued development of the Tilt Rotor research aircraft, a completely new class of vertical rising, short-haul aircraft--as well as work on QSRA and RSRA research aircraft, and the Oblique Wing aircraft.

Also under Syvertson, Pioneer spacecraft went to Saturn and left the solar system altogether. And the Center solidly established itself as leader in application of super-computers to basic fluid flow problems and aircraft design research (using computation speeds of a hundred million operations per second). Ames also completed the transition to lead center for helicopter research and technology in NASA. It handled Shuttle entry heating problems, developed the IRAS telescope, and the Galileo entry probe craft--slated to make the first entry into the atmosphere of an outer planet (Jupiter) in 1988.

The Center also made a major exploration of Venus. This continues as data comes in from the Pioneer spacecraft still in orbit around the cloud-draped planet. In doubling the size of the 40 x 80 foot wind tunnel (already the world's largest), Ames acquired a major new aerodynamics research facility. Syvertson also led directly in greatly expanding Ames work in aeronautical human factors, including the new Manned Vehicle Systems Research Facility.

Briefly, Syvertson's career went as follows. Born in 1926, he earned a bachelors degree with distinction from the University of Minnesota in 1946 in his home town, Minneapolis. This was followed by a year as a private in the then Army Air Corps, and another year studying for a Master's at Minnesota. He joined Ames in 1948 as a research scientist and later became assistant chief of the 10 x 14 inch wind tunnel. Over the next two decades, he wrote 35 technical papers mostly on supersonic and hypersonic flight. In 1958, he received the American Institute

of Aeronautics and Astronautics Lawrence Sperry Award. In 1959, he was named chief of the 3.5 foot hypersonic tunnel, which he had designed. In 1963 he was selected to head the Mission Analysis Division. In 1964, he received the Space Act Inventions Award (with three others) for the lifting body concept. In 1965, he chaired the Ames Lifting Body Research Team. In 1966, he was named Director of Astronautics at the Center, and three years later, in 1969, was named Deputy Director of Ames. In 1977, he became Acting Director of the Center, and in 1978, Director.

Syvertson made major contributions to NASA and the Ames Research Center throughout his 35-year career. In the 1950's and 60's when NASA and its predecessor agency NACA were exploring the unknown hypersonic speed regimes beyond Mach 5 (five times the speed of sound), Syvertson made basic advances in aerodynamic analysis.

This work involved flight vehicles so fast they have yet to fly--such as hypersonic skip gliders, direct flight to orbit craft, or hypersonic transports.

Syvertson also did major research on supersonic vehicles, notably how to get a high lift to drag ratio for the supersonic B-70 bomber. These concepts were later incorporated into supersonic transport and other supersonic aircraft designs. Working with three others, Syvertson also was responsible for design and development of the first lifting body, the Ames M-2. Lifting bodies are wingless vehicles that in concept can fly back from 18,000 mph orbit into the atmosphere and land at airfields on Earth.

In the 1950's and 1960's, Ames was the home of high speed aerodynamics research. The Center had the talent and was unique in the country in having the requisite supersonic and hypersonic tunnels.

This research was required for design of the Shuttle. Without a knowledge of the flight regimes between orbital speed of 18,000 mph and landing speed of 210 mph, no shuttle could have been developed.

As Director of Ames, Syvertson pushed for the best in science and engineering talent, the best in facilities and the best balance of research. The Center has a variety of research, which has made selection of the most productive research goals essential.

In his early career at Ames, Syvertson developed a method of designing variable speed supersonic wind tunnels. With the exception of the 6 x 6 tunnel, he designed, or others followed his design methods, for all other supersonic tunnels at the Center. Key factor was a series of nozzle designs, each of which provided air-flow at a different Mach number (speed).

In theoretical work on flight at high supersonic speeds, his contributions to second order shock-expansion theory were especially important.

Syvertson designed, managed construction, and brought on line the Ames 3.5 foot wind tunnel, which can operate at speeds of Mach 5, Mach 7, Mach 10, and Mach 14 (14 times the speed of sound, about 9,000 mph).

The Lawrence Sperry Award, one of the outstanding honors in

aeronautics, was given to Syvertson for "fundamental understanding of hypersonic air flow and its application to efficient aircraft design." When he began work on hypersonic aerodynamics, says the citation, several theories existed for low supersonic speeds. Efforts to extend these theories to hypersonic speeds produced either doubtful results or cumbersome calculations. Syvertson and colleagues developed new theories, up to satellite speeds of 18,000 mph.

His work, the citation adds, has been particularly valuable because it sets out relatively simple methods which are being used in practical engineering design studies.

Syvertson received the NASA Exceptional Service Medal in 1971 for his work as Executive Director of the joint Department of Transportation-NASA Civil Aviation Research and Development (CARD) policy study. This major study was important to industry and government planning. It made a series of recommendations for future civil aviation policy.

Ames' retiring director was named a Fellow of the American Institute of Aeronautics and Astronautics in 1976, and a fellow of the American Astronautical Society in 1978. In 1977, he completed the Advanced Management Program of Harvard Business School. He was elected a member of the National Academy of Engineering in 1981. Syvertson now lives with his wife, JoAnn, and two daughters in Saratoga, California.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter Waller 415-965-5091

Rel. No. 84-03 IMMEDIATE

COMPUTER RESEARCH INSTITUTE
GETS UNDERWAY AT NASA-AMES

The newly-formed Research Institute for Advanced Computer Science (RIACS) of NASA's Ames Research Center will be unveiled for local industry and university professionals during an open house on Friday morning, January 27.

Qualified research professionals interested in attending should telephone the RIACS office at Ames, (415) 965-6363 for an invitation. The presentation will include a discussion of planned tie-ins with local industry, tour of facilities, and lunch. For those interested, a tour of Ames will be available in the early afternoon.

The new institute is located at NASA-Ames and is operated for NASA by the Universities Space Research Association (USRA), a consortium of 54 universities, which already manages a number of such enterprises.

The principal purpose of RIACS is to strengthen computer science at Ames by conducting basic research in areas relating to aerospace and by strengthening ties with universities and

industry. Formation of the Institute is in line with a general policy within NASA to strengthen advanced computer work on the theory that advances in most areas of science and technology will depend on new computer techniques.

Current research plans of the Institute fall into three main areas. The first is concurrent processing, which seems to have the greatest promise for attaining computation speeds of a billion computations per second and beyond.

The second area of research is expert systems, which are programs that simulate human experts in narrowly defined fields. Potential NASA applications include experiment planning on the Kuiper Airborne Observatory, aircraft design advising, and fault detection and repair on the proposed space station.

In the long run, RIACS hopes its expert-systems research will broaden into areas of artificial intelligence with potential applications in space systems. (Artificial intelligence involves the creation of systems which can remember new cases as they experience them, and apply this knowledge to future problems.)

The Institute will pursue the above objectives with a combination of permanent staff, and an active visiting scientist program. A broad, long-term goal of the group is to integrate computation into every aspect of scientific investigation.

The Institute is empowered to accept "tasks", short-term, joint projects with existing groups and projects at Ames. These will be done primarily by experts in computer science on short-term (usually under two year) appointments at the Institute.

Initial tasks of the Institute are with the Ames Numerical Aerodynamic Simulator project (NAS). NAS is planned as a complex of supercomputers--the world's highest speed processors. It is intended eventually to provide numerical solutions of high-speed air flow with the same accuracy and speed of wind tunnels--at much less cost.

The Institute also has tasks to work on simulation of basic chemical processes (computational chemistry), concurrent processing, and aircraft design.

These problems, too, require high-speed super computers.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

IMMEDIATE

Peter Waller 415-965-5091

Margaret Scheitrum

RELEASE NO. 84-07

TO EDITORS:

New evidence for gigantic active volcanoes on Venus will be presented at a news briefing at NASA Ames at 10 AM, Monday, February 13, 1984.

A variety of findings point to huge scale volcanism on the planet. These will be presented by Pioneer Venus investigators Drs. Larry Esposito of University of Colorado, Boulder; Fred Scarf of TRW, Redondo Beach, CA; and Harold Masursky of US Geological Survey, Flagstaff, AZ.

Esposito will present data supporting a major volcanic eruption on Venus, many times larger in magnitude than any volcanoes on Earth during the last 100 years. Esposito bases his findings on five years study of atmospheric data from the Pioneer Venus orbiter. His data indicate that concentrations of sulfur dioxide in the Venusian atmosphere increased more than 50 times in 1978 and have been declining ever since. Esposito attributes the abnormally high amounts of sulfur dioxide to a mjaor volcanic eruption which occurred on the planet sometime shortly before Pioneer Venus began its explorations in 1978. This is quite similar to major increases in atmospheric sulfur dioxide which occur after volcanic eruptions on Earth.

Volcanic activity has been suspected on Venus for some time. Scarf will present new findings which tie lightning to the volcanic mechanism. He analyzed over 1200 orbits of Pioneer Venus and uncovered evidence for huge clusters of lightning bolts on the planet. The lightning is concentrated near the surface of two mountainous regions - Beta Regio and Atla Regio. Lightning-like discharges are known to be generated in terrestrial volcanic plumes.

- more -

A review of the physical characteristics of Venus will be presented by Masursky. He will discuss in detail the very large scale Beta and Atla mountain regions, which are the only recent volcanic sites on Venus, based on topography, gravity sensing data and radar altimetry images.

News people attending the briefing should come to the NASA gate of Moffett Field. From there they will be directed to the Space Science Auditorium in Building 245.

For television, a videotape and other visuals will be available.

###

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-965-5091

Rel. No. 84-09

For Release
Thursday, Feb. 9
11 a.m. PST

FIRST ATMOSPHERE PROBE CRAFT
FOR AN OUTER PLANET COMPLETE

The Galileo Probe Spacecraft, which will make history's first entry into the atmosphere of an outer planet, has been completed.

The new Galileo probe will accomplish the unprecedented first entry into Jupiter's atmosphere and then fly 400 miles deep into the giant planet's atmosphere. Jupiter entry is by far the most difficult in the solar system because of the planet's huge gravity. The Probe will descend through Jupiter's turbulent and brilliantly-colored cloud layers and pass into the hot, dense atmosphere below.

The new five-foot-diameter probe craft, which is almost half heat shield, will enter Jupiter's atmosphere at 115,000 mph--fast enough to get from Los Angeles to New York in a minute and a half. Maximum G forces on the vehicle during entry will be 350 times Earth gravity. After entry and separation of spent heat

shields the Probe's parachute-borne Descent Module will study Jupiter's three main cloud layers, encountering hurricaine winds up to 200 mph and perhaps heavy rain at the base of the water clouds believed to exist on the planet. Seven instruments will provide the first direct information on the nature of Jupiter's atmosphere and clouds.

Engineers and project officials from NASA and Hughes Aircraft will give the new craft final approval at a "pre-ship review" today, Thursday, Feb. 9, at Hughes, El Segundo, CA. With completion, the Galileo Probe will go from Hughes to the Jet Propulsion Laboratory, Pasadena, CA for integration with the Galileo Orbiter spacecraft which will carry it until five months before Jupiter entry.

The Galileo Probe project is managed by NASA's Ames Research Center, Mountain View, CA. Hughes Aircraft Co., El Segundo, is spacecraft builder, and the heat shield was developed by General Electric Co., Philadelphia.

Over all manager for the Galileo Project is NASA's Jet Propulsion Laboratory, Pasadena, CA.

Purpose of the over all Galileo Mission is to conduct a comprehensive exploration of the Jupiter system using two vehicles, a long-lived Orbiter and the Probe.

The Galileo Probe will provide the first information by direct measurement on chemical composition and physical state of Jupiter's atmosphere and clouds. All Probe data will be radioed to the Orbiter, flying a parallel course 120,000 miles above, for retransmission to Earth.

The Galileo Orbiter will provide the first long-term, close-up observations of the Jupiter system. The Orbiter will encounter Jupiter's remarkable, planet-sized Galilean satellites repeatedly, typically 100 times closer than did Voyager.

During the 20-month life of its mission, the Orbiter will complete 11 orbits of Jupiter. It will return about 50,000 high-resolution pictures of Jupiter and its planet-sized moons, and will make a close fly by of at least one Galilean satellite--Io, Europa, Ganymede, or Callisto--on each orbit. Each of the Galilean satellites is a world of its own. Io, for example, has currently active volcanos. Io is believed to be the most active volcanic body in the solar system.

The 2550 kg (5622 lb) Galileo orbiter/probe spacecraft will be carried to low Earth orbit by the Space Shuttle in May 1986. It will be launched from Earth orbit to Jupiter by the first of the modified "wide body" Centaur vehicles, which have 50 per cent more fuel capacity than previous Centaurs. The wide-body Centaur is the only vehicle with enough total thrust to send the combined Galileo craft across the half billion miles from Shuttle orbit to Jupiter. The Centaur vehicle is managed by NASA's Lewis Research Center, Cleveland.

The Galileo Probe will separate from the Orbiter five months before planet-arrival and follow its own trajectory to Jupiter entry. Arrival at Jupiter of both Orbiter and Probe is currently scheduled for August 25, 1988. After entry, the Probe mission will be complete in 60 to 75 minutes, when the Orbiter moves out

of range, and conditions in the deep atmosphere exceed Probe design limits. During this data-return period, the Orbiter will be positioned 100,000 miles directly overhead to receive Probe data. Immediately after the end of the Probe data period, the Orbiter will reorient for a close flyby of planet-sized Io, and Jupiter orbit insertion.

For the mission of the Galileo Probe, science objectives are to characterize Jupiter's atmosphere by determining 1) its chemical composition, including minor constituents, isotopic ratios, and the hydrogen/helium ratio 2) its density profile from initial detection to mission end, and 3) its temperature and pressure profiles.

The remaining science objectives are: 4) to find location and structure of Jupiter's clouds. 5) the atmosphere's radiative energy balance, and 6) existence and characteristics of Jovian lightning.

These atmosphere characteristics will be found by direct measurement from several sensors in the Probe Deceleration Module or from the seven instruments aboard the parachute-borne Descent Module. Measurements should be possible down to at least 20 bars atmosphere pressure (20 times Earth's sea-level pressure) before end of communications. Maximum possible depth before cutoff of radio communication is 25 bars pressure, and 25 km (15 mi) deeper than the planned mission. There the Orbiter must turn away for Io encounter. At this point, the Probe will have operated 75 minutes since atmosphere entry.

Other Probe science will be measurements of Jupiter's

numerous radio emissions, characteristics of trapped high-energy particles down to the atmosphere top--far closer than measured by Pioneer 11's 41,000 km (26,000 mi) closest approach to Jupiter. The Probe will measure wind shears by Doppler radio measurements made aboard the Orbiter.

The Probe mission has four phases: launch, cruise, coast, and entry-descent. During launch and cruise, the Probe will be carried by the Orbiter, and serviced by a common umbilical. The Probe will be dormant during cruise except for periodic checkouts of spacecraft systems and instruments every six months. During this period, the Orbiter will provide the Probe with electric power, commands, data transmission and some thermal control.

Five months before planet arrival in late March 1988, the Orbiter will spin up and aim the Probe on its entry trajectory. The spin-stabilized Probe will separate and fly to Jupiter. Six hours before atmosphere entry, the Probe will be going about 65,000 kmh (40,000 mph). At that point, its command unit signals "wake up" and it begins collecting science.

From there it will accelerate steadily until it enters the atmosphere at 185,000 kmh (15,000 mph). The incandescent shock front ahead of its heat shield will be as bright as the Sun.

The shields experience peak heating of 40 kilowatts per square centimeter from the 16,000 degree C (28,000 degrees F) shock wave temperature. Peak G forces occur about two minutes after entry. About four minutes after entry, drogue chute deploys, and aft cover is pulled away. Main chute opens and the Deceleration Module with its massive heat shield falls away.

From there on, the Descent Module with its seven scientific instruments moves downward toward the brilliant cloud tops. (See table at end for instrument measurements.)

The Probe's total weight is 331 kg (728 lb). The Deceleration Module, which carries the heat shield and aft cover weighs 214 kg (470 lb) and the Descent module, nested inside the Deceleration Module weighs 118 kg (260 lb). The Descent Module carries 28 kg (62 lb) of scientific instruments.

The 145 kg (319 lb) Probe heat shield is a 45-degree-half-angle blunt cone. It is made of carbon phenolic material.

Probe communications are provided by two L-band transmitters. These can be used to check each other for proper function, and provide two channels for return of data from Jupiter's unknown atmosphere.

Probe power comes from a high-discharge-rate 34-volt lithium battery, which must remain dormant for more than two years, en route to Jupiter.

The Probe's command and data system provides commands, telemetry, data storage, and timing. It uses two redundant data strings each with its own processor.

The Probe Relay Radio aboard the Orbiter will have two redundant receivers which process Probe science data, plus radio science and engineering data for transmission to the Orbiter communications system. The unit must automatically acquire the Probe signal 100,000 miles below within 50 seconds, with a success probability of .995. It must reacquire immediately if the signal is lost. Minimum received signal strength is

31 dB-Hz. The receivers also measure signal strength and Doppler for wind measurements and atmosphere-transmission characteristics.

In addition to processing the Probe data and sending it to Earth in real time, the Orbiter will store it for later retransmission.

PROBE INSTRUMENTS	CHEMICAL COMPOSITION	PHYSICAL STRUCTURE 1. DENSITY (INDIRECT) 2. TEMPERATURE, PRESSURE	CLOUD LOCATION AND COMPOSITION	RADIATIVE ENERGY BALANCE	ELECTRICAL DISCHARGES 1. OPTICAL EMISSIONS 2. RADIO SIGNATURES	ENERGETIC PARTICLE POPULATION
NEUTRAL MASS SPECTROMETER (NMS)	√					
HELIUM ABUNDANCE DETECTOR (HAD)	√					
ATMOSPHERE STRUCTURE INSTRUMENT (ASI)		√ √				
NEPHELOMETER (NEP)			√			
NET FLUX RADIOMETER (NFR)				√		
LIGHTNING AND RADIO DETECTOR (LRD)					√ √	
ENERGETIC PARTICLE INSTRUMENT (EPI)						√

Galileo Probe science objectives.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller 415-965-5091

IMMEDIATE

Rel. No. 84-18

AMES-STANFORD FORM SPACE INSTITUTE

NASA's Ames Research Center and Stanford University have formed the Stanford-Ames Institute for Space Research to pursue joint undertakings in space research, astrophysics, and technology development.

An agreement establishing the Institute will be signed at Ames by Ames Director William F. Ballhaus, Jr. and by Dean Norman K. Wessels of Stanford at 3 p.m., Friday, March 16.

Both organizations already carry out substantial independent space science activities, and have cooperated on some limited space efforts in the past. The new institute is intended to foster joint research, and the sharing of technical capabilities and people.

Plans are being considered under the new arrangement, for courses and seminars at Stanford in areas of Ames research to be taught by Ames scientists. In some cases, Ames researchers will hold uncompensated consulting Professorships.

Stanford students may work on scientific projects at Ames. There will be mutual use of shops and computer facilities where

practical. A space science and astrophysics seminar series to be held periodically each year, and a summer faculty fellowship program for professors from other universisties are planned. Opportunities for post-doctoral fellows to collaborate in joint research programs may be provided, and distinguished scientists from the U.S. and abroad will be brought to Stanford-Ames.

The new Institute will be administered by a Chairman from Stanford, and an Associate Chairman from Ames, as well as by an eight-member executive committee, composed of half Stanford and half Ames scientists.

First Chairman of the Institute is Professor Vahe Petrosian, Stanford, and first Associate Chairman is Dr. Lawrence Colin, chief of the space sciences division at Ames. Stanford members of the executive committee are: Professors Arthur Walker, Von R. Eshelman, Robert Wagoner, and Robert Helliwell.

Ames members are: Drs. Harold P. Klein, Palmer Dyal, Henry Lum, and Patrick M. Cassen.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller

Nancy Kiley 415/965-5091

Release No. 84-24 IMMEDIATE

NASA TO DEDICATE UNIQUE AVIATION SAFETY FACILITY

Pilots will soon be able to "fly" into crowded airports while under the direction of an air traffic controller, deal with other approaching aircraft, extreme weather conditions, and even mechanical failures--all from the safety of the ground.

These ground-based studies of pilot responses, controller commands and air traffic operations plus evaluation of new procedures and systems will further improve safety in the air.

A unique new NASA facility makes this possible. The Man-Vehicle Systems Research Facility (MVSRF), at Ames Research

-more-

April 23, 1984

Center, is dedicated entirely to the study of aviation human factors. This includes such things as pilot fatigue and stress, and complex operations. It allows study of the interaction among flight crews, their aircraft, air traffic control and as many as 36 other aircraft. This type of research has not previously been possible. Until MVSRF, simulators have been used primarily for developing and testing aircraft hardware and software systems, and for crew training, rather than for human factors research.

Human error plays a part in 60 to 80 percent of all aviation accidents, according to studies done by a number of organizations. The new facility will allow scientists to study how errors are made, as well as how automation and advanced instrumentation affect human performance.

The Man-Vehicle Systems Research Facility allows complete simulation of flight missions. Observer stations are provided both inside the simulators' two transport aircraft cockpits and also at remote locations. From these observer stations, experimenters can introduce problems such as turbulence, traffic, fog or mechanical failure or otherwise modify planned scenarios during the simulation. Scientists can study how decisions made in the cockpit are affected by environmental and hardware problems and by availability of information (from the ground and from the aircraft) about flight status.

The new facility houses two flight simulators which can be operated independently of each other or interactively as two

aircraft flying in the same airspace. There is also a mock air traffic control station and pilot stations from which other aircraft can be entered into the network to give the pilots realistic air traffic situations.

One of the simulators, the Advanced Concepts Flight Simulator, represents technology for aircraft projected to be flying about 1995. This cockpit of the future has certain features which more resemble a modern office than a flight deck. It houses advanced technology, desk-top flight controls and displays that make use of small side-stick controls instead of the usual steering wheel and column, and cathode ray tubes with touch sensitive panels for pilot interactions. The Advanced Concepts Flight Simulator was developed jointly by NASA and the Lockheed-Georgia Company.

The other simulator is a replica of the cockpit of a Boeing 727 Series 200, complete with pilot, co-pilot and flight engineer's stations and flight displays and control systems. It is capable of providing motion in six degrees: forward and backward, upward and downward, sideward, pitch, roll, and yaw; enabling the crew to experience the "seat-of-the-pants" feel of the flight. The 727 Simulator was built by Singer-Link of Binghamton, New York.

A computer visual system provides out-the-cockpit-window

displays for the two simulators. These can depict approaching aircraft and the entire landscape of many of the major airports in the U.S. They can also provide dusk, or night, fog, clouds and many other weather conditions. Unusual locations, such as seascapes or mountainous terrain can also be provided for simulator "pilots".

Auditory cues complete the realism with the sounds of aircraft engine operation, landing gear extension, aerodynamic noise and runway effects.

The 727 Flight Simulator and Air Traffic Control Simulator became operational in January, and the Advanced Concepts Flight Simulator will begin operation in July. Dedication ceremonies of the Man Vehicle Systems Research Facility will take place at Ames Research Center in Mountain View, California on May 8, 1984.

####

-end-

April 23, 1984

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 965-5091

Rec'd May 8, 1984

Peter Waller 415-965-5091

For Release

IMMEDIATE

Rel. No. 84-26

To editors:

NASA-Ames will demonstrate for news media its new, first-of-its-kind facility for research on human interactions in complex aircraft operations at 10 a.m., Tuesday, May 8. News reporters also are invited to formal dedication ceremonies at Ames at 3:30 p.m. that day.

The $8.5 million complex promises to further improve aircraft safety by creating difficult flight situations safely on the ground. It can study human interactions among crews of up to 38 aircraft, various flight environments, and teams of ground control personnel. It is the first facility devoted entirely to study of aircraft human factors. The Man-Vehicle Systems Research Facility (MVSRF) can realistically duplicate, on the ground, "flight" into crowded airports, traffic control operations, other aircraft interactions, extreme weather conditions, and mechanical or electronic failures.

The facility is interesting visually, and reporters will be able to fly the simulator, as "pilot" in the Boeing 727 look-alike cockpit, following the news briefing. For television, there will be a TV clip showing various operations, as well as a series of large graphic displays. Various print information will be provided.

Formal dedication ceremonies at 3:30 p.m., the same day, will be attended by notables from NASA headquarters, Congress and other government organizations, and by representatives of industry and universities. Speakers are Dr. William Ballhaus, Ames Director; Dr. Jack Martin, NASA Associate Adminstrator; and Gen. Billie J. McGarvey, Director of Facilities, both from NASA headquarters. A reception will follow the ceremonies.

News people planning to attend the briefing should come to the NASA gate of Moffett Field, and will be directed to the MVSRF facility from there. To attend the ceremony, come to the NASA-Ames Visitor Center.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 965-5091

Peter Waller
Amy McKay 415-965-5091
Release No. 84-27

For Release

IMMEDIATE

Pioneer Venus Orbiter Observes Comet Encke

Comet Encke, now traveling between Earth and Venus, is losing water at a rate approximately three times higher than expected for its distance from the Sun. This surprising finding, scientists say, could be due to the particular arrangement of ice and dust that the comet is made of, or to crumbling of "mesas and hills" that may cover the surface of the 2 kilometer (1.2 mile) diameter comet nucleus.

The Pioneer spacecraft in orbit around Venus made the Comet Encke observations. On April 13, mission controllers at NASA's Ames Research Center turned the long-lived Orbiter upward from observing the cloud shrouded planet to look across the solar system at the passing comet.

The Pioneer Venus Orbiter was launched in 1978 to make a detailed scientific study of Venus, and the spacecraft continues to study atmospheric circulation and other Venus phenomena. However, the recent comet observation was only the second time since Venus arrival that the Orbiter has been used to observe

-more-

another object.

Since Comet Encke is closer to the sun than the last time measurements were made, in 1980, astronomers expected the rate of water evaporation to be higher, but only a third as high as the Pioneer observations indicate.

Comets are thought to be made mostly of dust, rocky material and water ice-- cosmic dirty snowballs hurtling through space. But the distribution of cometary ingredients may vary, which could explain why the rate of water evaporation varies.

Astronomers theorize that the ice and dust could be distributed unevenly, so that as the comet rotates, at the rate of once every six and a half hours, it exposes different materials to the Sun. Particularly icy portions would vaporize faster. And since comets probably aren't smooth round balls, surface irregularities like steep-sloped hills and mesas may also cause variations in water evaporation rates. However, the exact make-up of comets-- whether the ice and dust are layered, mixed together in chunks, or form hills and valleys-- remains a mystery.

To make the observations of the Comet Encke, NASA aerospace engineers tipped the Pioneer Orbiter 37 degrees to its orbit plane so that the Ultraviolet (UV) Spectrometer would be in a position to observe the comet. The UV Spectrometer, one of the many scientific instruments on the Orbiter, detects light in the ultraviolet region of the spectrum. In addition to observing Comet Encke, researchers also rechecked the spectrometer's calibration by gathering data on the star Spica.

-more-

Members of the Pioneer Operations team sent commands for maneuvers from the Pioneer Mission Operations Center at Ames Research Center. They controlled the Venus Orbiter's tilt by firing pulses from one of the seven rocket motors, or thrusters, on the spacecraft, and they reversed the procedure to tip it back.

The Orbiter spins about five times a minute as it travels around Venus in its orbit. By selecting the right time during each spin for the Orbiter to fire its thruster, and by choosing the number, length, and direction of the thruster pulses, team members could tilt the spacecraft to the desired position. For the Encke observation, they moved the Orbiter's spin axis by firing some 200 pulses each a half second long.

The UV spectrometer observed Comet Encke and the star Spica for about one and a half days, and the data were sent for analysis to scientists at the University of Colorado at Boulder. There, a team of researchers, headed by Dr. Ian Stewart, the principal investigator for the UV Spectrometer instrument on the Orbiter, calculated the comet's rate of water loss.

Because most atoms emit UV light when they're bathed in sunlight, measuring the wavelength and intensity of the emitted light can give scientists an idea of what elements are in a sample as well as how much of an element or compound is present. By measuring hydrogen emissions over a period of time, the Colorado researchers found that Comet Encke was losing water at a rate approximately three times higher than expected based on

earlier measurements.

Researchers analyzing data from the International Ultraviolet Explorer (IUE) satellite confirm the Pioneer Venus Orbiter results. The IUE, operated from NASA's Goddard Space Flight Center in Maryland, observed Comet Encke from the end of April to mid-May.

The Pioneer spacecraft is managed by NASA's Ames Research Center in Mountain View, California and was built by Hughes Aircraft Co. of El Segundo, California. The UV Spectrometer was built by the University of Colorado at Boulder.

The French astronomer Pierre Méchain discovered Comet Encke in 1786, but the comet was named after Johann F. Encke, a German astronomer who calculated the comet's orbit in 1818. Encke also noted that the comet was behaving abnormally. Its period, the time it takes to travel once around the sun, was getting shorter, in apparent contradiction to the laws of classical physics.

Later, astronomers found other comets with deviations in their periods, but it wasn't until more than a century after Encke's observation that scientists developed the currently accepted explanation of the phenomenon. Comets spin slowly like frozen tops in their orbits around the Sun. But the ice vaporizes, particularly when the comet is near the Sun, and may cause a jet reaction that can change the comet's orbital path. The result: slight deviations in the comet's period and orbit.

Encke was the first to discover a comet with such aberrant behavior, and because of the historical interest as well as the short period of the comet--it comes around every 3.3 years, so it

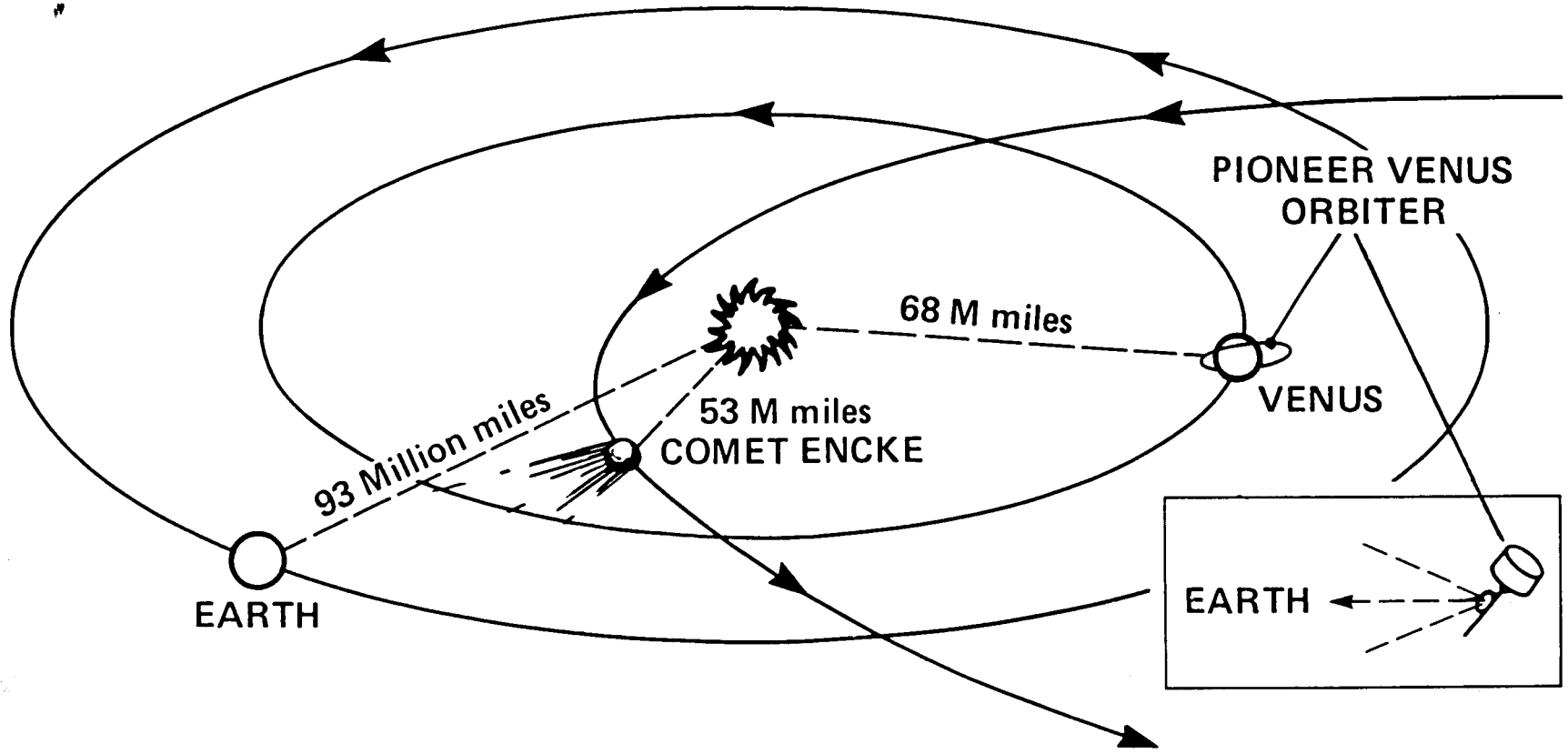
can be observed often-- Comet Encke has become one of the most carefully studied comets of them all.

June 1, 1984

-end-

VIEW OF SOLAR SYSTEM SHOWING COMET ENCKE

(APRIL 15, 1984)



NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:
Immediate

Peter Waller (415)965-5091

Charles Knox

Release No. 84-28

Pioneer 10 Passed Beyond Planets One Year Ago

One year ago today, June 13, 1983, the Pioneer 10 unmanned spacecraft became the only man-made object so far to have passed beyond all the known planets. It was launched in March of 1972 for a 21-month mission to Jupiter. It passed the asteroid belt and other obstacles before reaching the largest planet in the solar system in December, 1973.

Today Pioneer continues to relay information to scientists on Earth. In fact, Pioneer 10 has now transmitted well over 126 billion bits of scientific data and travelled almost 4 billion miles from Earth.

Managed by NASA's Ames Research Center in Mountain View, California, Pioneer 10 has achieved more than one first. Among others, it was first in charting Jupiter's intense radiation belts and first in recording the properties of the Jovian planet's four largest moons.

-more-

Perhaps the most important Pioneer discovery was that the Sun's atmosphere, the heliosphere, does not end at the orbit of Jupiter; the spacecraft has still not detected the boundary of the solar atmosphere. Even at the outermost known planetary orbit, the magnetic field of the Sun's heliosphere shelters the solar system from most cosmic ray particles.

Pioneer 10 still has work ahead, as it seeks gravity waves and a tenth planet. Unexplained perturbations in the orbits of Uranus and Neptune have historically caused scientists to search for such an object beyond Neptune and Pluto.

As the probability that Pioneer 10 will collide with any object in the vacuum of interstellar space is incredibly low, the craft may continue travelling virtually forever. Scientists expect it to outlast our solar system.

The spacecraft's course will carry it past Barnard's Star, a small, cool, red star and one of the Sun's closest neighbors, at a distance of 3.8 light years in 10,507 years. This fly-by will be the spacecraft's first encounter with another star, although it will not be its closest. NASA scientists calculate that Pioneer 10 will pass within 3.2 light years of a star named Ross 248 roughly 32,000 years from now. Ross 248, a red dwarf star, is notable for its emission of flares which are similar to solar flares but are much more powerful.

As Pioneer 10 continues its trek away from Earth at a speed of around 30,000 miles per hour (roughly 5,000 m.p.h. above the speed necessary to escape the solar system), its radio signals to Earth become increasingly faint. Currently it takes a signal

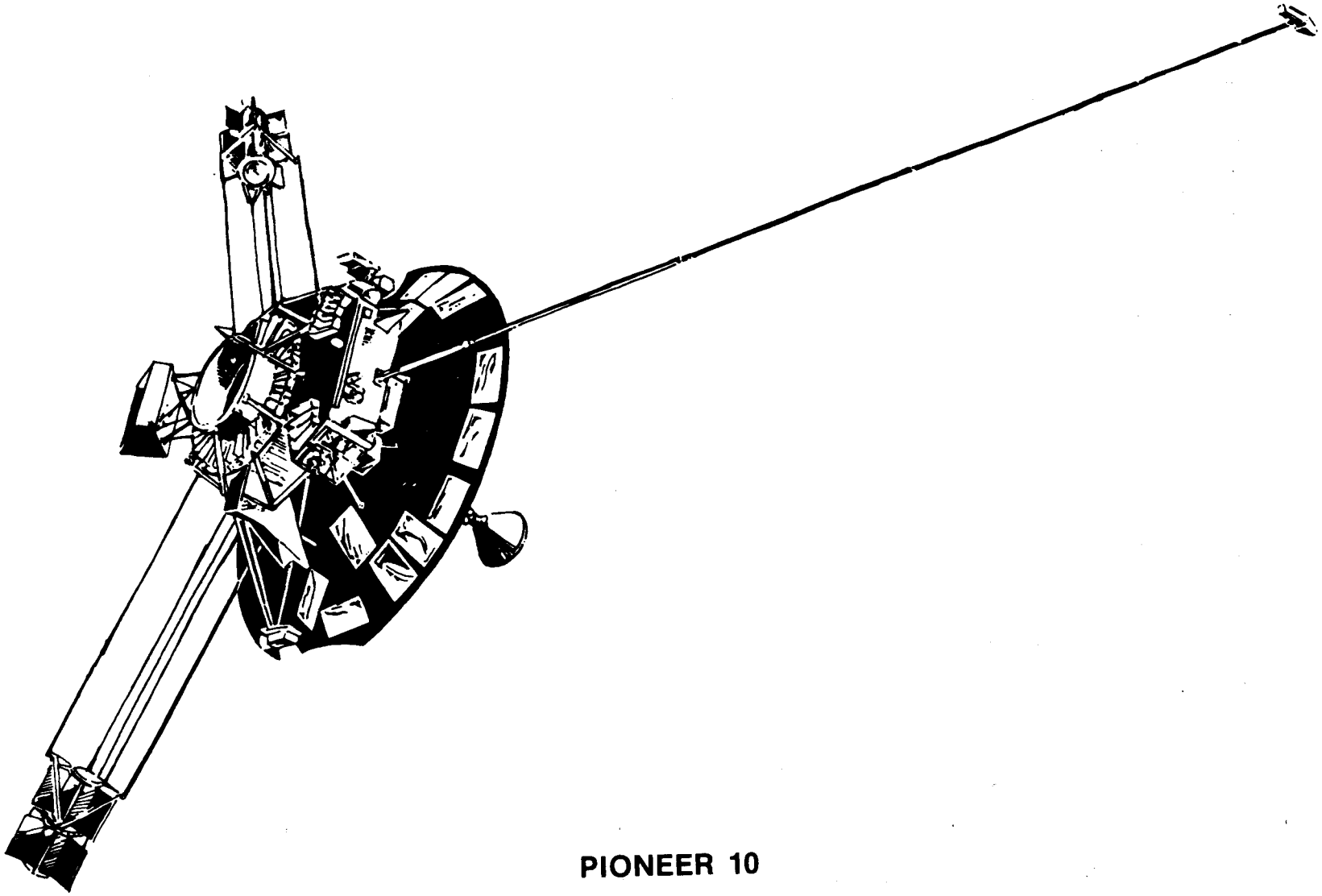
from the spacecraft about five hours to reach Earth, and this time interval increases by about a minute every four days.

In addition, the spacecraft's 8-watt transmission (whose power is about equal to that of a miniature light bulb) is weakened to a barely detectable few-thousand-trillionths of a watt by the time it reaches radio receiving antennas on Earth. Still, NASA scientists hope to track Pioneer 10 through its radio signals for seven more years, at which time it will be at a distance of five billion miles from Earth.

The spacecraft carries with it a plaque on which is inscribed a message intended to be decipherable by intelligent life forms, should Pioneer 10 encounter any on its endless journey. The message pinpoints the location of our solar system and of the Earth in reference to easily identifiable objects, pulsars, in our galaxy, noting that our planet is the craft's point of origin. The message also depicts a man and woman in a pose of friendly greeting, along with some basic points of science useful in interpreting the diagram.

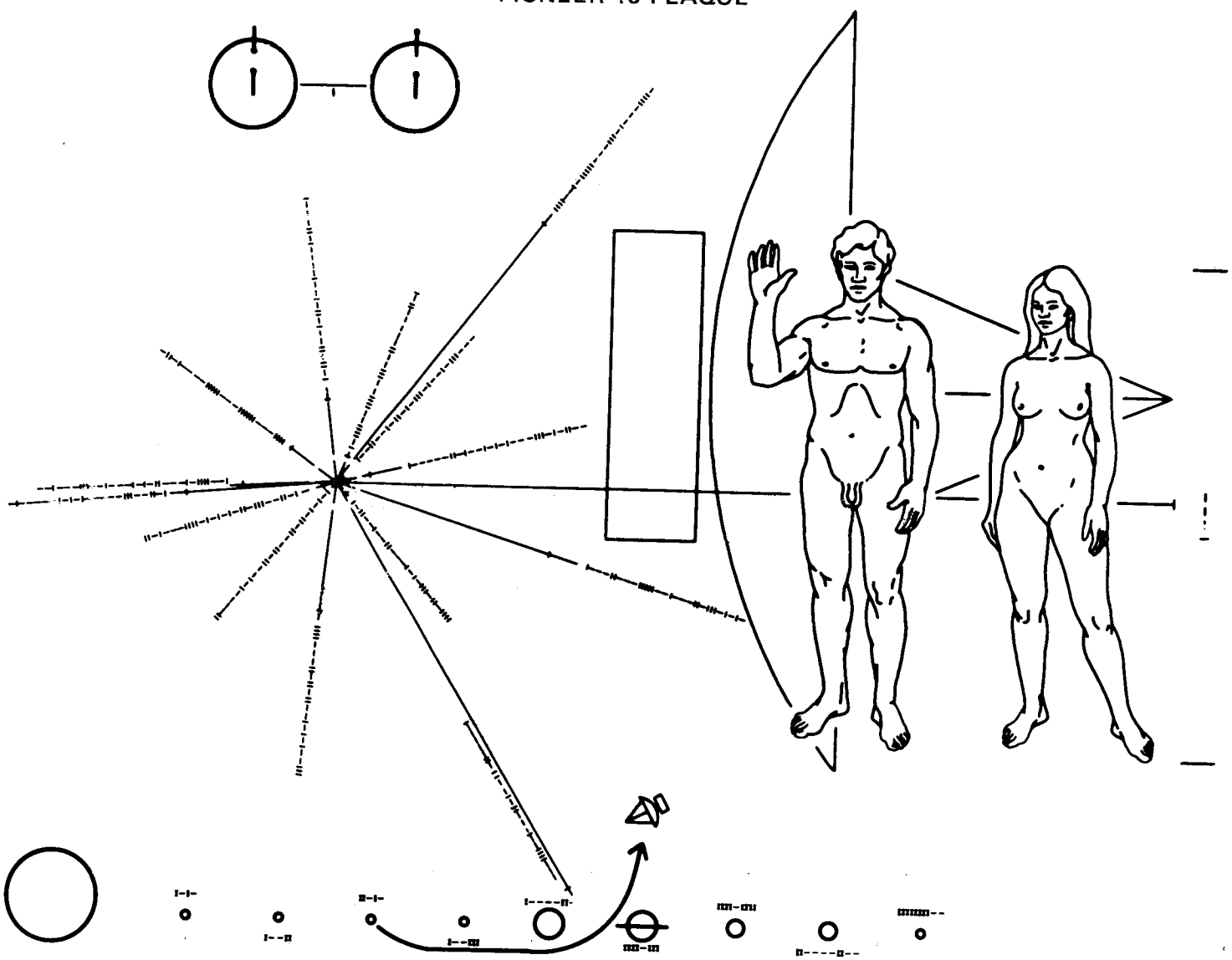
-30-

6/13/84

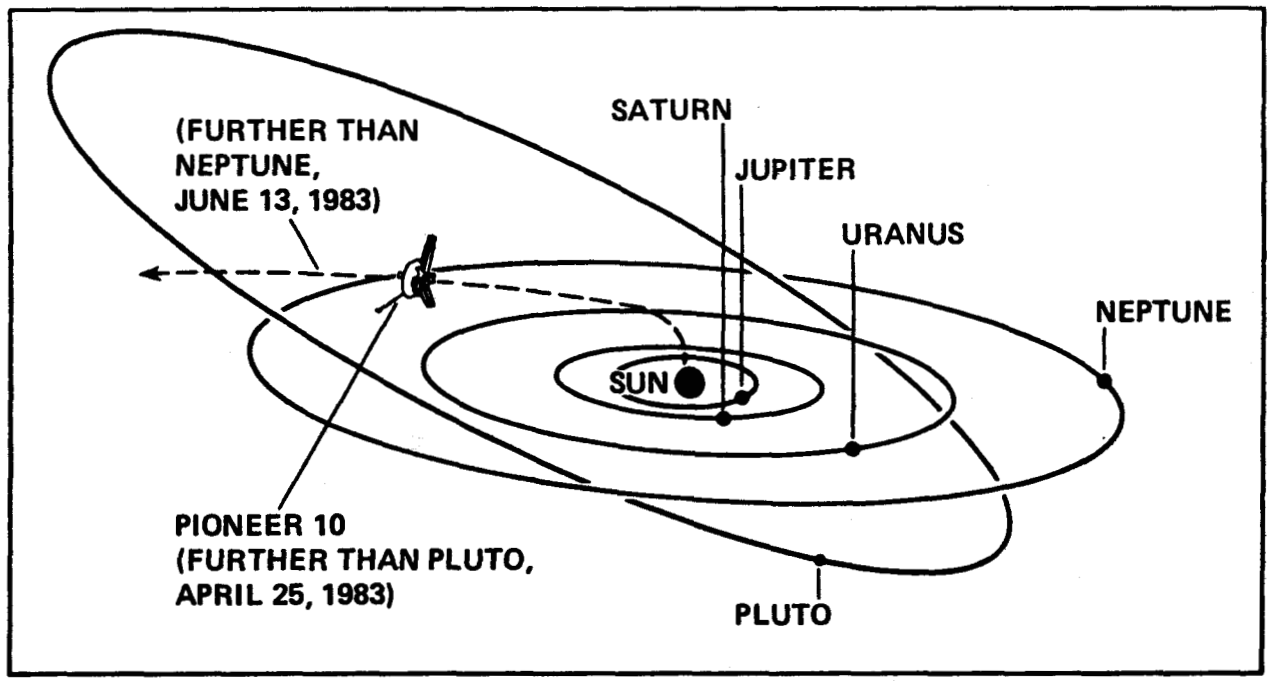


PIONEER 10

PIONEER 10 PLAQUE



PIONEER EXIT FROM SOLAR SYSTEM



Because Pluto will be inside Neptune's orbit for the next 17 years, the current limit of the solar system (distance of the outermost planet from the Sun) is at Neptune's orbit. Since Pluto takes 250 years to circle the Sun, it will be relatively close to Neptune's orbit for the next 50 to 75 years, long after Pioneer has departed into interstellar space.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

date? –

For Release:

Peter Waller
Amy McKay (415) 965-5091
Release No. 84-31

IMMEDIATE

mailed July 20

PIONEER WILL MAKE MAJOR HALLEY'S COMET OBSERVATION

NASA plans to reorient the Pioneer spacecraft now in orbit around Venus to look at Halley's Comet in early 1986, as the comet hurtles between Venus and the Sun on its 76-year tour of the solar system.

This will give the U.S. a major observation of Halley's Comet, because the Pioneer Venus Orbiter will be the only spacecraft in a position to observe the comet when it is most spectacular-- at perihelion, the point where a comet comes nearest the Sun and is most active.

Because the Earth will be on the opposite side of the Sun from both Venus and the comet at perihelion, direct observations from our planet will be extremely difficult. But Halley's Comet will be easily seen from the Pioneer Orbiter spacecraft at Venus.

The Pioneer data, together with information from other observations, will provide a detailed scientific portrait of Halley's Comet, which has been observed at every passage since 87 B.C. but which won't be seen again until the year 2061 (see p. 6

-more-

for lively Halley history.)

The Pioneer Orbiter was launched in 1978 to make a detailed scientific study of Venus, and the spacecraft's on-board instruments continue to study atmospheric circulation and a variety of other Venus-related phenomena. However, the Halley observation will be only the third time the Orbiter will have been moved to observe another object. It will be its second look at a comet.

Comets are thought to resemble gigantic dirty snowballs made up of mostly dust, rocky material, and water ice. As they speed towards the inner solar system, attracted by the Sun's gravitational force, the intense heat of the Sun vaporizes the ice and the comets grow the tail of gases and dust for which they are best known.

To observe the gases and dust emanating from Halley's Comet, NASA mission controllers at Ames Research Center, Mountain View, California, must tilt the Pioneer Orbiter so that its Ultraviolet (UV) Spectrometer can point at the passing comet. The UV Spectrometer, one of the many scientific instruments on the Orbiter, detects light in the UV region of the electromagnetic spectrum. UV light is invisible and among other things, causes sunburn.

Most atoms emit UV light when they're exposed to sunlight. By measuring the wavelength and intensity of the emitted light, scientists can determine which elements are in a substance and in what amount. Data from the Orbiter's UV Spectrometer will characterize the comet's gas composition, its water vaporization

rate, and its gas to dust ratio.

Comets are thought to be frozen remnants of the material that formed the Sun and the planets, so information on cometary ingredients can provide clues to the early chemical and physical history of the solar system.

Astronomers theorize that most comets reside far beyond the planets as a vast "cloud," known as Oort's Cloud, which is believed to be stocked with trillions of comets. Only a relatively few journey to the inner solar system, and even fewer are captured into orbit to return again and again.

Halley's Comet comes around every 76 years, and during this passage it will reach perihelion-- the point where it comes closest to the Sun-- on February 9, 1986. There, the raging heat of the Sun vaporizes the comet's ices faster than at any other time. The resulting gases, excited by the sunlight, will emit light themselves; and the dust particles dragged off the comet with the vaporized ice will reflect high levels of the Sun's light, causing Halley's Comet to be at its brightest.

At this time, unfortunately, the comet will be on the far side of the Sun, and direct observations from the Earth will be nearly impossible. In fact, Halley's Comet won't be the visual spectacle it has been in past apparitions because of the adverse celestial geometry during its 1986 passage. Ray L. Newburn, a leader of the International Halley Watch, says the 1986 appearance will be the "worst viewing for the naked eye in the last 2000 years."

But the planet Venus will be relatively close to Halley's

Comet at perihelion, so the Pioneer Venus Orbiter will be particularly well-placed for viewing the comet. Halley's Comet will be observed for six to eight weeks in February and March 1986.

Pulled by the same gravitational force that keeps the planets revolving in their orbits, Halley's Comet will swing past the Sun at about 180,000 km/hr (111,852 miles/hr). Thus, to gather data on the fast-moving comet, the Pioneer Orbiter must regularly be moved to track it.

To practice making the major maneuver necessary to observe Halley's Comet, mission controllers tilted the Orbiter by 37 degrees in mid-April 1984 to look across the solar system at Comet Encke. The data from the Pioneer Orbiter were surprising--Comet Encke was losing water at a rate approximately three times higher than expected for its distance from the Sun. This suggests that the materials making up Comet Encke are not mixed together well.

For the Halley observation, members of the Pioneer Operations team will send commands for Orbiter maneuvers from the Pioneer Mission Operations Center at Ames Research Center. To control the Pioneer Orbiter's tilt, team members will fire pulses from one of the seven small rocket motors, or thrusters, on the spacecraft.

The Orbiter spins five times a minute as it travels in its orbit around Venus. By selecting the right time during each spin for the Orbiter to fire the thruster, and by choosing the number, length, and direction of the thruster pulses, engineers will be

able to tilt the spacecraft to the desired position. For the Halley's Comet observation, the pointing of the Orbiter's spin axis will be moved in small increments. The Orbiter will fire a total of some 1000 pulses each a half second long, and the entire maneuver will use about half of the spacecraft's useable fuel reserve.

Because the UV Spectrometer has a small field of view and is always rotating, it will "see" only a strip of Halley's Comet during each spin.

However, by tipping the Orbiter so the UV Spectrometer can view another area, a two-dimensional image of the entire comet can be built up, strip by strip.

The Orbiter's data will be sent to scientists at the University of Colorado at Boulder. There, a team of researchers, headed by Dr. Ian Stewart, the principal investigator for the UV Spectrometer instrument on the Orbiter, will analyze the data.

The Pioneer spacecraft is managed by NASA's Ames Research Center in Mountain View, California and was built by Hughes Aircraft Co. of El Segundo, California. The UV Spectrometer was built by the University of Colorado at Boulder.

Other NASA observations of Halley's comet include those from the Shuttle-borne Astro 1 and Spartan missions, in which a variety of UV sensitive instruments and cameras will look at the comet. NASA also plans observations from the International Cometary Explorer spacecraft, the Solar Maximum Mission and International Ultraviolet Explorer satellites as well as several sounding rockets. In addition to these remote observations, the

European Space Agency's Giotto spacecraft and two spacecraft from the Soviet Union and one from Japan will make close passes by Halley's Comet about a month after perihelion. They will make in-place measurements of the dust and gases emitted by Halley's Comet.

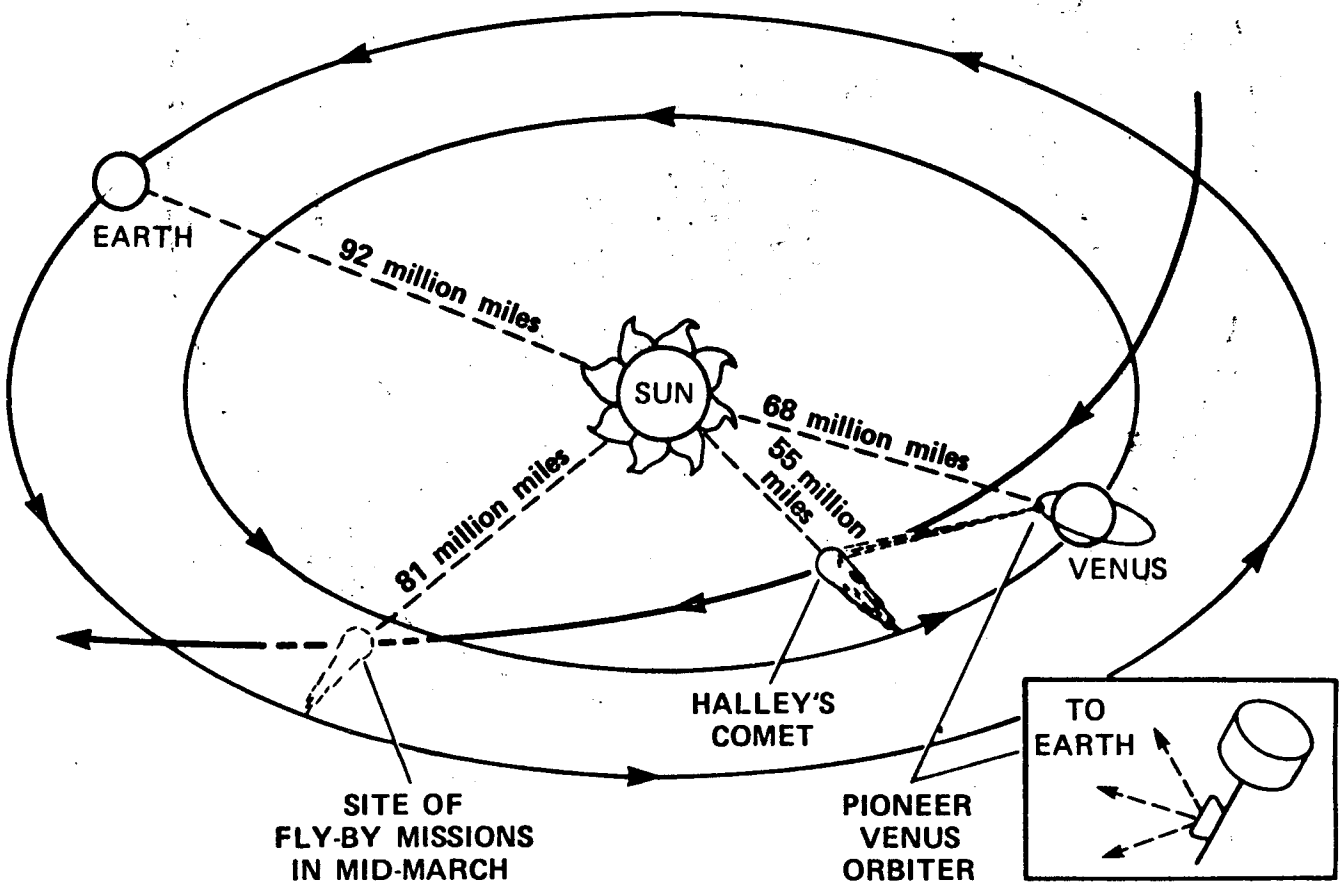
In its earlier appearances, Halley's Comet was thought to be a portent of historic events, usually unpleasant ones. It was believed to have foretold the death of Agrippa in 11 B.C., the destruction of Jerusalem in 66 A.D., and the the defeat of Attila the Hun in 451. Before English astronomer Edmond Halley calculated the comet's elliptical path around the sun, in the early 1700s, many astronomers had thought comets were random celestial occurances.

But Halley, who had studied numerous other comets, noticed that three of them-- the comet he observed in 1682 and two earlier comets-- followed remarkably similar paths. These three came about 76 years apart, and Halley surmised they were actually periodic appearances of the same comet. He even predicted that the comet would show up next in 1758. Halley was right, and the comet he observed now bears his name.

-end-

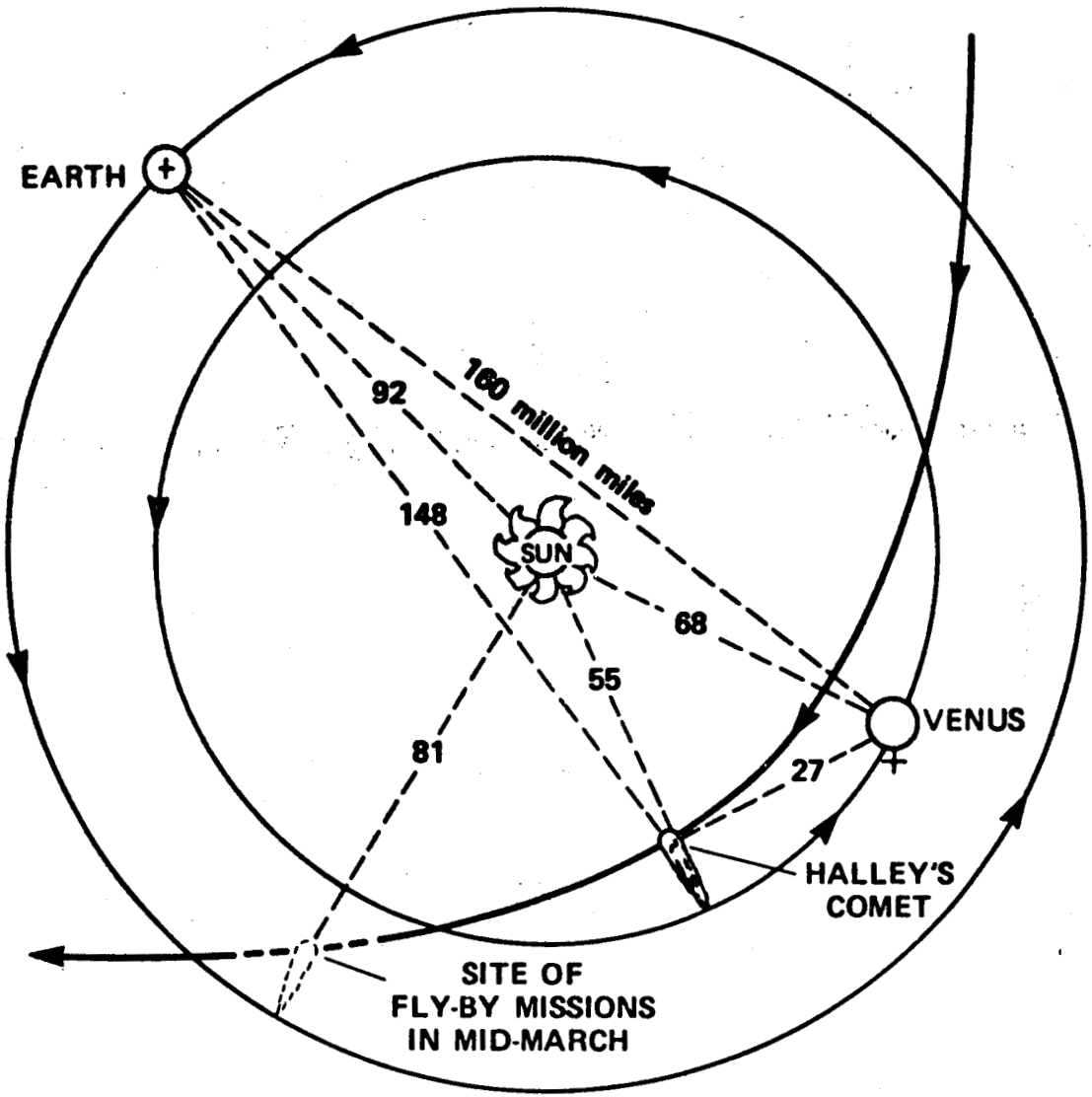
VIEW OF SOLAR SYSTEM SHOWING HALLEY'S COMET AT PERIHELION

FEBRUARY 9, 1986



VIEW FROM CELESTIAL NORTH POLE OF HALLEY'S COMET AT PERIHELION

FEBRUARY 9, 1986



NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Larry King (415) 965-5091

Charles Knox

For Release:

July 16, 1984

Release No. 84-33

AIRBORNE SCIENCE AND APPLICATIONS PROGRAM
CELEBRATES 20TH ANNIVERSARY

On July 13, NASA's Airborne Science and Applications Program celebrated its 20th anniversary of contribution to the advancement of science. This year also marks the 10th anniversary of one of the program's most significant projects, the Gerard P. Kuiper Airborne Observatory.

The Airborne Science and Applications Program (ASAP) consists of a fleet of high and medium altitude airborne research platforms. They serve a variety of scientific purposes. They obtain astronomical, Earth resource, atmospheric, oceanic, and biological data, and they test materials and equipment for NASA's space investigations programs. They also provide verifying information for various Earth satellites.

The Kuiper Airborne Observatory (KAO) is perhaps the best known of the ASAP programs. A highly modified version of the Lockheed C-141 military cargo transport aircraft, it carries a 36

-more-

in. (0.92 meter) diameter infrared telescope dedicated to astronomical research. The KAO/C-141 is a medium altitude aircraft. It makes observations from altitudes of between 37,000 and 45,000 feet (9.1-13.7km).

ASAP's other medium altitude aircraft include a Learjet, a Convair 990 named Galileo II, and a Lockheed C-130. The program's high altitude aircraft, the U-2 and ER-2, fly at 70,000 feet (21.3km).

The KAO flies at an altitude that puts it above most of the water vapor in the Earth's atmosphere. This allows for more accurate measurements of radiation from space than would be possible with atmospherically-obstructed, ground-based telescopes.

In the last decade the KAO has provided valuable information on planetary atmospheres, stellar formation and evolution, and conditions in other galaxies. Its major accomplishments include verification of a source of infrared radiation at the center of the Milky Way, discovery of rings around Uranus, and discovery of a heat source within Neptune.

KAO also has been involved in the study of molecular species and has identified almost thirty in our solar system alone. Prior to KAO's first flight, only five were known. KAO has also identified over forty molecular species in various regions of our galaxy.

Another important obsevatory is ASAP's Learjet. Its observations concentrate on life sciences and astronomy. Among its major accomplishments are the discovery of sulphuric acid in

the atmosphere of Venus, measurement of water vapor in the atmosphere of Mars, and measurement of heat on Jupiter and Saturn. The Learjet's studies of low altitude wind shear in our own atmosphere are helping pilots to fly more safely.

The Lockheed C-130 airborne observation platform is the lowest-flying of the ASAP planes. It's maximum flight altitude is 25,000 feet. But a higher altitude is not desirable, since the C-130 primarily studies Earth resources, such as agriculture, meteorology, and geology. The C-130's sophisticated mapping equipment investigates crops, soils, and non-renewable resources.

ASAP's Convair-990/Galileo II aircraft has participated in many important international atmospheric and weather research and astronomical observation programs. It is the fastest aircraft in the NASA fleet.

The Galileo II accommodates up to 35 on-board researchers, which allows for many different experiments to be carried out on each flight. Its use in international cooperative studies helps scientists from all over the world better understand how our planet and atmosphere interact.

The Galileo II's recent accomplishments include exploration into the origin of Monsoons in India, investigation into air-ice-ocean interaction off the northern coast of Greenland, and study of global atmospheric effects resulting from the eruption of Mexican Volcano "El Chichon."

ASAP's high-flying observatories, two Lockheed U-2's and their upgraded version, the Lockheed ER-2, also study atmospherics, oceanography, and Earth resources. They have been

instrumental in verifying observations made by various satellites and the Space Shuttle. They have tested and demonstrated new remote sensing techniques, and they have provided information for Earth resource programs.

The U-2's and ER-2 also collect data for atmospheric sampling and disaster assessment. One of the U-2's was used to measure ash cloud dispersement following the May, 1980 eruption of Mt. St. Helens. In addition, the three high flying observatories carry out severe storm measurement and observations to aid in our understanding of the weather.

-30-

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter Waller (415) 965-5091

Charles Knox

August 9, 1984

Release No. 84-39

NASA AIRBORNE LABORATORY TO STUDY L.A. SMOG

NASA's Galileo II Airborne Laboratory will fly over the Los Angeles basin next week to study how the area's smog varies with altitude and geographical location. Scientists aboard the airplane will measure the concentration of ozone, nitrogen oxide, and aerosols in the lower atmosphere. Galileo II will make two flights between August 12 and 18, one during the late afternoon and one during the early morning. These flights are intended to coincide with times of peak and low smog.

The airborne laboratory's two flights are part of a larger effort, known as "Project BASIN." The objectives of Project BASIN, scheduled to run from August 5-18, are to examine how smog is affected by temperature, wind, humidity, and topography, to determine what smog really is, and to help create a model of the atmosphere in the Los Angeles basin. Project BASIN is being coordinated by the State of California Air Resources Board, which is providing the major funding.

-more-

The Air Resources Board and NASA's Marshall Space Flight Center of Huntsville, Alabama will be involved in recording data on-board Galileo II. The Galileo II flights will originate from NASA's Ames Research Center in Mountain View, California.

Other government agencies participating in Project BASIN include the Environmental Protection Agency, the United States Forest Service, and the South Coast Air Quality Management District. A number of schools, including UCLA, San Jose State, CalTech, and UC Irvine will also be involved.

The participating groups primarily will be making ground-based measurements to augment the flight data. However, in addition to Galileo II's two flights, the Environmental Protection Agency and State Air Resources Board will initiate another six flights with smaller aircraft. Galileo II's flights will also provide information for pilots and navigators on how wind circulates in the Los Angeles basin.

To study the smog, Galileo II must fly at altitudes of 2500 to 6000 feet (750-1800m). This is because the smog is kept close to the ground by what is known as an "inversion layer." This layer exists where temperature stops decreasing with altitude and begins to rise with increased distance from the ground. A temperature inversion reflects the presence of high pressure air descending into the basin area. This descending air holds the smog close to the ground.

Because the plane will be flying at relatively low altitudes, it may generate a noticeable amount of noise. According to Galileo II Overall Project Manager John Reller,

"This unique research aircraft is vintage 1964 and is not equipped with the quieter engines of new aircraft." Noise will not persist in any one neighborhood, since the flying laboratory will scan the entire metropolitan area during its two three-hour passes over the basin.

In addition to producing noise, Galileo II's engines may emit a noticeable exhaust trail of fine carbon particles. This type of exhaust is characteristic of the previous generation of jet engines.

Although the carbon is a visual pollutant, it is no more harmful than emissions from conventional jetliners. In fact, says NASA Airborne Science Chief Robert Cameron, "The carbon emissions are not as harmful to air quality as are some of the invisible emissions from many newer commercial aircraft." These newer jets emit pollutants, such as carbon monoxide and sulphur dioxide, in much greater quantities than does Galileo II.

-30-

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

27 Aug 84

Peter Waller (415) 965-5091

Charles Knox

Release No. 84-40

For Release
Immediate

BACTERIAL ENZYME MAY BE REMNANT OF EARLY EVOLUTION

The simplest version ever seen of one of life's basic enzymes has been found by NASA scientists in a salt-loving bacterium. Until now only one form of this energy-producing enzyme, ATPase (Adenosine Triphosphatase), was known to exist in all living systems. Researchers believe that the newly discovered ATPase may be a leftover from early evolution. They hope it will provide a model for how early cells functioned.

The bacterium containing this simpler enzyme is one of a small group called Archaebacteria. It is one of three types of Archaebacteria. Another is found in the stomachs of cows, while the third grows in hot springs.

These organisms differ from all other bacteria in many ways. For example, the RNA base sequences of the genetic code in the Archaebacteria show strong similarities to each other, but only vague similarities to the RNA in other bacteria.

The bacterium under investigation is extremely halophilic,

-more-

"This unique research aircraft is vintage 1964 and is not equipped with the quieter engines of new aircraft." Noise will not persist in any one neighborhood, since the flying laboratory will scan the entire metropolitan area during its two three-hour passes over the basin.

In addition to producing noise, Galileo II's engines may emit a noticeable exhaust trail of fine carbon particles. This type of exhaust is characteristic of the previous generation of jet engines.

Although the carbon is a visual pollutant, it is no more harmful than emissions from conventional jetliners. In fact, says NASA Airborne Science Chief Robert Cameron, "The carbon emissions are not as harmful to air quality as are some of the invisible emissions from many newer commercial aircraft." These newer jets emit pollutants, such as carbon monoxide and sulphur dioxide, in much greater quantities than does Galileo II.

-30-

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

27 Aug 84

Peter Waller (415) 965-5091

Charles Knox

Release No. 84-40

For Release
Immediate

BACTERIAL ENZYME MAY BE REMNANT OF EARLY EVOLUTION

The simplest version ever seen of one of life's basic enzymes has been found by NASA scientists in a salt-loving bacterium. Until now only one form of this energy-producing enzyme, ATPase (Adenosine Triphosphatase), was known to exist in all living systems. Researchers believe that the newly discovered ATPase may be a leftover from early evolution. They hope it will provide a model for how early cells functioned.

The bacterium containing this simpler enzyme is one of a small group called Archaebacteria. It is one of three types of Archaebacteria. Another is found in the stomachs of cows, while the third grows in hot springs.

These organisms differ from all other bacteria in many ways. For example, the RNA base sequences of the genetic code in the Archaebacteria show strong similarities to each other, but only vague similarities to the RNA in other bacteria.

The bacterium under investigation is extremely halophilic,

-more-

which means that it thrives in a salty environment. Its growth in the San Francisco Bay salt ponds gives the ponds their red color.

NASA researchers are the first to locate the ATPase in the salt-loving bacterium. ATPase is associated with the highly complex process of energy transduction. No cell can function without carrying out this process.

Dr. Lawrence Hochstein discovered the unique enzyme at NASA's Ames Research Center in Mountain View, California. According to Hochstein, ATPase must have had an early origin in evolution, since it performs an essential function and is found in all living creatures. The fact that only a very complex ATPase exists in present living systems led the Ames group to search for evidence of a simpler, earlier version.

The new findings show that the ATPase in the salt-loving bacterium has no more than four subunits, and it may have as few as two. This is significant, since the ATPase in all other living things studied has five subunits. These subunits, made of proteins, determine the structure and function of the enzyme.

Since the new-found version of ATPase may be a simpler precursor of contemporary ATPases, studying its unique properties may help piece together the puzzle of cell evolution.

NASA scientists still must establish how the ATPase works in the salt-loving bacterium. By comparing its function to the way in which these enzymes operate in other organisms, the researchers may develop functional models for early cells. The ATPase is studied by breaking open a cell and separating the

enzyme from the cell's other parts.

Hochstein and his colleagues Horden Kristjannson and Wijaya Altekar are beginning to study a second type of Archaebacteria in an attempt to confirm the current findings.

-30-

8/27/84

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller 415-965-5091

IMMEDIATE

Rel. No. 84-47

PARKER AND KOURTIDES NAMED
FOR EXCALIBUR AWARD

Dr. John Parker and Mr. Demetrius Kourtides of NASA's Ames Research Center, Mountain View, CA have been named jointly to receive the Congressional Excalibur Award. The Ames scientists were selected for their outstanding achievements in the field of aviation fire prevention and safety.

Parker and Kourtides of the Chemical Research Projects Office have been concerned with the evolution of polymer science and technology and improving the fireworthiness of domestic transport aircraft over the past seven years. Through individual research and leadership of a scientific team, they have provided modifications of aircraft materials that should save lives in future aircraft fires. Recently, they have developed fire-blocking materials which will dramatically extend the time for passengers to leave burning aircraft. Other contributions have been development of fire-resistant, transparent aircraft window materials, and advanced interior wall panel systems to block either external or interior fires.

Parker is an international authority on aircraft fire safety. Kourtides has a long list of contributions, and also is internationally known in the field. Parker has served three years on the National Academy of Sciences committee on polymer flammability, and has co-authored a nine volume series on the subject. He has held a number of similar posts and has received various other awards for his work. These include the NASA Exceptional Scientific Achievement Medal in 1968 for Pioneering work in the field. He was awarded the GEICO Public Service Award in 1984, and a Congressional Flag Recognition and Certificate by the House Oversight Committee, also in 1984.

The Excalibur Award is a Congressional award for Federal, military, and civilian personnel honoring contributions at local, national, or international levels. The awards were presented at a ceremony at the U.S. capitol.

Parker is a resident of Los Altos, CA. Kourtides lives in Gilroy, CA.

- end -

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Lisa Peterson 415/694-5091

Release No. 84-48

November 8, 1984

AMES SET TO NEGOTIATE FOR NAS COMPONENTS

NASA's Ames Research Center, Mountain View, CA, has selected Amdahl Corporation of Sunnyvale, CA for negotiations leading to award of a contract to develop the Integrated Support Processor Complex for the Numerical Aerodynamic Simulation (NAS) Processing System Network. Estimated value of the contract is between $8 and $9 million.

The NAS network is a supercomputer system planned to reach speeds of a gigaflop (one billion calculations per second) for aerodynamic simulation and other scientific calculations. The functions to be performed for NAS by the new equipment include support processing for smaller program uses; a long-haul communication system for remote users including industry, universities, and other NASA centers; and a memory of 200 billion words for mass data storage on a disc.

The selection was made under a firm fixed price contract. Amdahl Corporation will perform the work at Sunnyvale, CA; Nagano, Japan; Louisville, CO; and Poughkeepsie, NY.

# # #

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Peter Waller (415) 694-5091

Charles Knox

IMMEDIATE

Release No. 84-50

WIND TUNNEL COMPONENTS ARRIVE AT NASA/AMES

The first of the new drive-fan blades and air-flow turning vanes needed for completing the enlargement of the world's largest wind tunnel have arrived at NASA's Ames Research Center in Mountain View, California.

The project doubles the size of the tunnel, converting the former loop tunnel with its 40-by-80-foot test section into two tunnels sharing a common drive. It increases top speed of the old loop tunnel from 230 to 345 mph. The newly added straight-through tunnel will have a top speed of 115 mph, and an 80-by-120-foot test section. This is large enough for full-scale tests with engines running of new, large aircraft with 100-foot wing-spans. Such aircraft would be medium-sized commercial transports, like the Boeing 737.

The increased size and speed capability of the tunnels is important for testing new powered lift and high-speed rotorcraft concepts. These improvements are also important for developing

aircraft with high-lift systems that reduce takeoff and landing distance, and for testing new aircraft noise reduction concepts. This new test capability is expected to make important contributions to both civil and military aviation.

Once installed, the new tunnel components will propel and direct air flow through either the existing 40-by-80-foot (12 x 24 m) test section or the new 80-by-120-foot (24.4 x 36.6 m) test section of what has now been designated the National Full-Scale Aerodynamics Complex (NFAC) at Ames.

Current work on the tunnel is due to an accident in December 1982 during early test runs, when a vane set broke loose damaging the drive fans.

In addition to structural repairs and replacement of damaged turning vanes and fan blades due to the accident, further flow and structural analyses have been done. As a result of these, two of the old vane sets will be replaced and three other sets will be modified and strengthened. Tunnel walls will be reinforced, and studies are being conducted of the flow quality in the 80-by-120-foot tunnel inlet to define modifications that will improve flow quality.

These changes will ensure meeting structural strength and performance criteria. They also will ensure that the new tunnel will last another 40 years--matching the 40 years of service of the 40-by-80 foot tunnel since its original construction in 1944.

Total cost of the NFAC construction is $111.5 million.

NFAC aeronautical research operations are scheduled to resume in early 1986.

NFAC's 600-foot (182 m)-long straight-through leg containing the new test section attaches to one side of the old continuous-loop structure which houses the 40-by 80-foot test section. The two test sections are separate but served by the same set of drive fans.

Six new electric motors, each driving a 15-blade fan, will power the tunnels. The 12 foot (3.7 m) long fan blades, made by Permali Ltd. of England, are constructed of Canadian spruce, fiberglass, and steel.

The new, more powerful motors and fan blades are the reason for the increased speed of the 40-by-80-foot tunnel--to top speeds of 345 mph (555 km/h) compared to the previous 230 mph (368 km/h).

The original tunnel incorporated four sets of turning vanes to direct the air through the tunnel circuit. With the addition of the new 80-by-120-foot test section, five new sets of vanes were added to allow switching the tunnel air stream from the 40-by-80-foot test section to the 80-by-120-foot test section.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Received
Dec. 14, 1984

Peter Waller 415-694-5091

Susan Baer

Rel. No. 84-51

For Release
IMMEDIATE

NEW RESEARCH ON CLEAR-AIR TURBULENCE

New findings by NASA on the nature of high-altitude, clear air turbulence (CAT) may eventually lead to its prediction and enable pilots to route their airplanes around the invisible swirls of wind.

Aircraft incidents involving clear-air turbulence occur infrequently over the United States and Canada. Hence, the probability that anyone will find himself in this uncomfortable situation is quite small. However, the ability of these wind swirls to cause a jumbo jet to bounce during an otherwise smooth flight is of concern when the turbulence is severe. This also applies to the new generation of smaller executive aircraft now being certified to cruise at high altitudes.

The new findings, based on data gathered from airline flight-data recorders, provide the first detailed description of hazardous clear-air turbulence. This phenomenon is a series of swirls or vortices of air imbedded in upper-level wind streams at altitudes between 35 and 40 thousand feet. The swirls may range in diameter from 900 to 1,200 feet.

Findings show that a jet traveling at 500 miles per hour flies through a single vortex core in about one second. Within that one second, the plane is pushed upward and then down again. Passengers are pushed into their seats with the weight of an extra G (a measurement of gravity). Those who are not belted in are likely to move toward the ceiling of the plane.

Two to four of these vortices may be encountered in succession about 4 seconds apart. Injuries occur to flight attendants, passengers using the lavatories and children sitting unbelted in adults' laps.

Investigators at NASA's Ames Research Center, Mountain View, Calif., have found that the strongest vortices occur at about 25 miles downwind of large thunderstorms or mountain ranges, which cause a swell in the upper-level wind stream.

NASA airplane dynamics experts Rod Wingrove, Ralph Bach and Rajiv Mehta, in cooperation with the National Transportation Safety Board, are working with aeronautics professor Ted Parks of the University of Arizona and meteorologist Peter Lester of San Jose State University, Calif., at the Ames Research Center to learn more about the phenomenon.

Pilots have been experiencing hazardous clear-air turbulence at high altitudes since World War II. However, collecting detailed information about it from airline operations has been possible only within the last few years since wide-bodied airliners began to use modern digital flight-data recorders. The NASA team compares the flight-recorder information with that from ground-based air traffic control radar records and weather data. This combination of information has been the key for Wingrove and his team to draw a detailed picture of the hazards of clear-air turbulence.

The team has found that the vortices are formed by wind shears at the tropopause, which is the boundary between the troposphere and the stratosphere. At the tropopause, higher velocity jet streams travel just above lower-speed windstreams. This difference in the speeds of the two wind flows is a form of wind shear.

The investigators have verified that wind shear layers which are pushed up over a thunderstorm or a mountain range act very much like ocean waves when forced to rise over an obstacle.

The air forms a series of swells which turn to waves that curl like the waves on the sea. These short air waves continue to curl until they form complete circles or vortices that whirl at high speeds. These vortices eventually disintegrate as they travel in the wind stream.

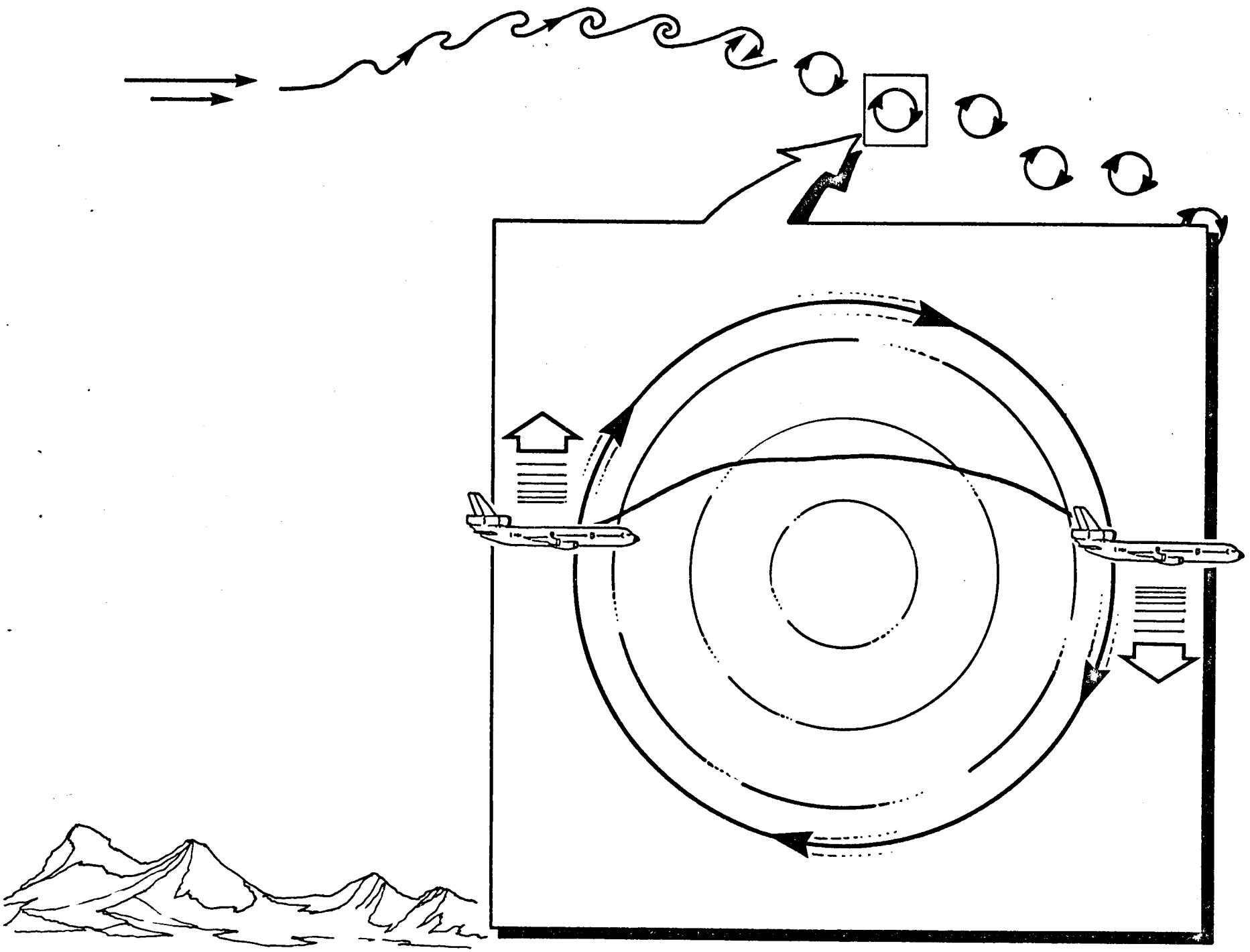
Planes flying into the wind have some warning of the disturbance ahead as they begin to encounter the relatively mild turbulence of the dissipating vortices. The airline captain can prepare the passengers and crew by turning on the seat belt signs. However, those traveling with the windstream may encounter the turbulence with little or no warning. As a result of its research, the NASA team hopes to one day be able to give pilots better indications of when and where the vortices may be encountered.

Wingrove and his fellow researchers have gathered their information from five cases in which jumbo jets encountered clear air turbulence over North America between 1975 and 1983.

The researchers also plan to set up a model of the turbulence on flight simulators at Ames this winter. They will simulate the flight of different types of aircraft through the vortices to see how each size aircraft reacts in turbulence of this kind.

- end -

CLEAR-AIR TURBULENCE



NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415-694-5091

For Release:
IMMEDIATE

Lori Stiles
University of Arizona, Tuscon, Ariz. 602/621-1877

Rel. No. 85-01

NASA-Ames, U. OF ARIZONA LAUNCH PROJECT
TO FIND PLANETS AROUND OTHER STARS

NASA's Ames Research Center and the University of Arizona will sign a Memorandum of Understanding, Tuesday, January 8, 1985, to formulate a program for the detection and study of planetary systems around other stars.

In signing the memorandum at ceremonies at NASA-Ames Mountain View, Calif., NASA and the University will launch an ambitious joint project to study, plan, and, if approved, develop an orbiting Astrometric Telescope Facility to be mounted on NASA's planned Space Station sometime in the mid 1990's.

"Astrometric telescopes are used to measure, with

extraordinary precision, the positions of stars and other celestial objects against the sky", says Eugene H. Levy, director of the U. of Arizona's Lunar & Planetary Laboratory, and head of its planetary sciences department.

Levy and David C. Black, head of Ames' Planetary Detection project, will be principal scientists in the collaborative project between the Ames Center's Space Sciences Division and the University's Lunar & Planetary Laboratory.

Black describes the project as "the beginning of a new scientific discipline. The results of the search, whether positive or negative, will profoundly alter our view of the universe".

The gravitational pull of planets orbiting around a star cause the star to wobble back and forth as seen against the sky. By measuring this wobble, an astrometric telescope can determine the presence of planets and even determine the properties of such a planetary system. This wobble-measuring technique is commonly used by ground-based telescopes to measure the properties of double stars in orbit around one another. However, to measure the disturbance in a star's motion caused by objects as small as planets, and to study the systems in detail, it requires more precise measurements than can be achieved from telescopes on the ground.

(The largest disturbance in the motion of our own sun is caused by Jupiter which moves the Sun back and forth a distance of about one million miles every 12 years. This distance is about twice the size of the Sun itself. The smaller planets

produce smaller disturbances in the Sun's motion. To carry out the measurements needed for this project will require that the positions of stars be measured with a precision comparable to measuring the size of a piece of blackboard chalk as seen at the distance between the Earth and the Moon.)

George D. Gatewood, a leading astrometrist who directs the University of Pittsburgh's Allegheny Observatory, conceived and developed a ground-based astrometric telescope similar to that planned for the Space Station. That instrument was put into full operation less than a year ago. Arizona's Optical Sciences Center is currently fabricating new optics for it. Gatewood, as Director of the Alleghany Observatory, is a principal collaborator with the U. of Arizona's Lunar & Planetary Laboratory on the Space Station astrometric telescope project.

"The best place to achieve maximum astrometric accuracy is from space -- above the Earth's atmosphere", Gatewood notes. Plans include close coordination between the Space Station project and the Allegheny Observatory's continuing ground-based program. "This close coordination will maximize the accomplishments of both programs", the scientist says.

Levy describes the jointly developed and operated Astrometric Telescope Facility as "the most exciting scientific project that one could think of doing from the Space Station."

Until other planetary systems are found and studied, the principal project researchers say that theoretical models developed to explain the origin of our own solar system, or the formation of stars, cannot be fully tested.

People have wondered about the existence of distant planets at least since the days of Classical Greece. But until recently, observing techniques and instruments have been too primitive to conduct the search for other worlds. In the coming decades, however, it should be possible to determine if Earth and its solar system are unique, rare or commonplace in the universe, Black says.

The memorandum, to be signed by William F. Ballhaus, Jr., director of the NASA-Ames Research Center and Henry Koffler, president of the University of Arizona, cites "the development and operation of a Space Station-attached Astrometric Telescope Facility" as a principal objective of the joint program. The program " will be coordinated with other joint efforts aimed at the detection and detailed study of planetary systems, including development of photometric and spectroscopic techniques and theoretical modeling of planetary system formation".

For more than a decade, Lunar and Planetary Laboratory scientists have been developing spectroscopic techniques and instruments for the discovery of other planetary systems.

Although the NASA center and the University will work together on the entire project, it is intended that Ames will coordinate the first two phases -- system definition and implementation -- and that the University will coordinate the two final phases -- the facility operation and scientific program.

While initial study and definition work will begin soon after the signing of the agreement, ultimate implementation of

the project will require that NASA obtain Congressional approval and funding for it several years from now.

Phase one is to clarify the final design of the telescope and how it is to be mounted on the Space Station.

Phase two would build the telescope and its instrumentation as well as mount it on the Space Station.

Phase three involves the establishment of the operating facilities on the ground.

Phase four includes the continuing scientific investigations, which would extend more than a decade. The scientists want the project to include a core program of planet detection and study, along with a program of guest investigations to make use of the unique capabilities of the telescope for astrometric studies of other important celestial objects.

According to the terms of the understanding, the Solar System Exploration Division of the NASA Office of Space Science and Applications, NASA Headquarters, Washington, D.C. will assume overall responsibility for the four-phase project.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 965-5091

Peter Waller 415-694-5091

For Release
IMMEDIATE

Rel. No. 85-06

NASA AMES FORMS ARTIFICIAL INTELLIGENCE
AND AUTOMATION SCIENCES GROUP

NASA'S Ames Research Center has named a new group to do basic and applied research in artificial intelligence (AI), automation sciences and space-related computer science technology. The group's work will stress applications to the NASA Space Station.

Ames has been designated NASA's lead Center in artificial intelligence research. To be known as the Information Sciences Office, the group will be headed by Dr. Henry Lum.

The new Office's research will cover AI programming languages, expert systems development, knowledge representation and information understanding, machine vision and learning, sensor fusion, and optical processing.

The space-related, computer-science research will focus on: symbolic processing and data flow architectures; network

design, protocols and simulation; and optical read/write information storage technology.

Office research goals and objectives will be accomplished through a combination of in-house research and a cooperative team of outside research organizations from industry and academia. In-house efforts will focus on applied research and the development of flight experiments to validate and demonstrate the technologies being developed. The cooperative research team activities will center around basic or fundamental research issues.

Cooperative team researchers will be people working under NASA grants and contracts to research team member organizations. Such organizations are SRI International, Symbolics Inc., Innovative Optics, Inc., Stanford University, U.C. Berkeley, MIT, University of Texas, and University of Michigan.

Expertise of the Office staff will be enhanced by both formal academic studies and on-site experience gained through "Apprenticeship Programs." These will be conducted at the facilities of the cooperative research team members. Duration of the apprenticeships are from six to twelve months. Three Office researchers are currently participating in the program.

Research of the Information Sciences Office will be oriented toward the user community, primarily other NASA Centers, with focus on both technology development for user applications and help to users during implementation. Space Station automation is the primary application. Agreements have been made with Johnson

Space Center, Houston, TX and Goddard Space Flight Center, Greenbelt, MD to work together in the implementation of AI technology for Space Station automation.

The Office has also been advising on Space Station automation through participation on several NASA advisory groups, such as the: Space Station Automation Study Team; Space Station Automation and Robotics Panel; Advanced Technology Automation Committee; and NASA Headquarters Space Station Data Systems Steering Committee.

The Office has also received approval for the conceptual development of a Space Missions for Automation and Robotics Technology (SMART) Program. This will be a multi-flight Space Shuttle and Space Station automation and robotics test facility for the validation of advanced robotics, automation, and telepresence technologies in a real-time operational environment.

The facility will be upgraded periodically by work of the Research Team organizations and available to all potential investigators. Other user related accomplishments to date include the development and successful implementation of expert systems for an astrophysics mission scheduler and a particle classifier for aerosol particulates obtained from upper atmospheric research flights, as well as technical consultation to the Army Aeromechanics Laboratory at Ames for automation of the helicopter environment.

The Office has established cooperative efforts with the Ames Aerospace Human Factors Research Division and with the Research Institute for Advanced Computer Science (RIACS) at Ames. This

will allow for joint investigation into man-machine interface research issues associated with autonomous systems, and the establishment of a high-speed data communications link with RIACS for resource sharing.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 965-5091

Peter Waller 415/694-5091

For Release:

Immediate

Rel. No. 85-10

Note to editors:

NASA's Ames Research Center will break ground on Thursday, March 14, for the building which will house the world's most powerful supercomputer system.

The new NAS supercomputer system is expected to reach computation speeds of 250 million calculations per second in 1986--and a huge, continuous one billion calculations per second (one "gigaflop") in late 1987. Much faster speeds of four billion calculations per second are planned for the 1990's.

The multicomponent NAS system will always use the two fastest supercomputers available at any given time. It will also have an extremely large memory (currently 120 billion characters of storage), plus main frame programming computers, computer graphic display systems, and other devices.

The NAS (Numerical Aerodynamic Simulator) system will be used to "fly" aircraft within the computer in ways which can replace many wind tunnel tests. Such computer-calculated air flow allows study of many more configurations for a proposed flight vehicle than does wind tunnel testing. While a portion of tunnel tests will still be needed, computer flight simulation will improve results, and save money.

(more)

Such high-speed computation should produce major advances in aeronautics. Highly complex aeronautical computation will be a strong driver for U. S. supercomputer development vs. very active competition from abroad.

NAS, a national facility, will also work on other highly complex problems, such as weather prediction, computational chemistry, and genetic engineering, for a variety of users.

A program to mark groundbreaking for this major facility begins at 9:30 a.m. with the groundbreaking itself set for 10:15 a.m.

The 90,500 square foot concrete structure will be occupied in December, 1986. It will provide a controlled environment for high-speed computers, special air conditioning, and is designed to promote efficient interactions between researchers and supercomputers.

News reporters planning to attend the ground-breaking should come to the NASA gate of Moffett Field and will be directed to the ceremony.

For television, a model of the building and a videotape showing building, supercomputer scenes, moving computer graphics, and footage of the first computer-designed, high-performance research aircraft will be available. There will also be printed material and pictures of building and computer.

A tour of Ames existing supercomputer facilities (including some NAS components) will take place after the ceremony.

March 7, 1985

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415/694-5091
Roberta Friedman

For Release:
Immediate

Release No. 85-11

Fact Sheet

NASA Numerical Aerodynamic Simulation Facility

NASA's Numerical Aerodynamic Simulation (NAS) Facility will house the world's most powerful supercomputer system.

Scheduled to start operations by mid-1986, the NAS computer network will be located at NASA's Ames Research Center in Mountain View, California. The system will be devoted to pioneering research and development in aerodynamics--the study of airflow around and forces generated by flying vehicles in Earth's atmosphere. In a sense it will be possible to "fly" proposed designs of new aircraft in the simulation facility.

A series of steps during the next decade will make the NAS network the most powerful computer system in the world.

*1986--

the Cray 2, the initial high-speed processor, will operate at a rate of 250 Mflops (million floating point operations per second) on aerodynamic applications; initial capacity of the central memory will be 256 million words (each word being 64 bits). A limited group of remote users will be able to access NAS.

(more)

*late 1987--

scale-up of speed to a billion flops; addition of advanced graphics displays and processing; additional remote users will be able to access NAS.

*1990's--

increases in memory to a billion words and speed to 4 billion flops.

Funding for NAS was approved in fiscal year 1984. The budget for the first year was $17 million. Total funding for the development phase of the project is estimated at $120 million (in fiscal year 1984 dollars).

Originally, NASA thought it would have to develop its own supercomputers to meet its needs. Now, with the availability of the Cray 2, the Cyber 205, and Japanese supercomputers, NASA can put together a system that incorporates commercially available supercomputers. In effect, NASA will serve as the testing ground for new advances in supercomputers.

Computer manufacturers are competing to supply the enormous computing capabilities that NASA needs for the late 1980's and 1990's. These companies include Cray Research, ETA Systems, and Denelcor of the U.S., and Fujitsu Ltd., Hitachi Ltd., and NEC of Japan.

A Complement to Wind Tunnels

Computer simulations will provide a needed supplement to aircraft wind tunnel testing. The cost of developing prototype aircraft and testing them in wind tunnels has substantially increased.

Meanwhile, the cost of computing time has dropped almost two orders of magnitude over the past decade, and the efficiency of

(more)

the calculation routines that generate computer solutions--algorithms--has increased dramatically. The exceptional speed and memory of the NAS system will allow scientists to simulate more complex configurations of aircraft and to more accurately approximate the Navier-Stokes equations, which physicists use to describe the flow of air around a solid body. Numbers generated by the supercomputers can be converted into computer-generated pictures or movies that show flow phenomena as they occur.

NAS will allow researchers to test a preliminary set of aircraft designs by computers. The best of the proposed designs can then be converted into models and "flown" in wind tunnels. This strategy will help scientists to pinpoint potential problems in a prototype aircraft design, and thus avoid costly alterations at later stages in the design process.

Features of the NAS Network

Whereas most computer centers are built around one manufacturer's machine, NAS is being set up to accept the newest and fastest computers from any company as they become available. The software and operating system for the network will be able to accommodate any manufacturer's product with minimal disruption.

This section details the basic features of the NAS network, a supercomputer system designed to incorporate the evolutionary advances necessary to maintain a state-of-the-art computational capability.

* High-speed processing will be the heart of the system. When the extended operational configuration is fully operational in 1988, two high-speed computers will reside in the system at all times. To update the system with the latest supercomputer technology, the older of the two computers will be replaced by a

(more)

new, faster computer as soon as it becomes available.

The first high-speed processor in the NAS system will be the Cray 2 supercomputer (leased from Cray Research, Inc.). It is scheduled to be installed in a temporary location at Ames by September, 1985. It represents the latest in computer miniaturizations: it is only four feet high and four feet in diameter (its walls are curved into a "C" shape).

The Cray 2 achieves its super speed from closely packed chips that are driven by a lot of power. But crowding and high power build up heat in a small space, so the densely packed chips could damage each other. To get around this problem, the Cray 2 is the first computer to have its chips totally immersed in an inert fluid that draws away excess heat. The fluid, which is also used as an artificial plasma to replace human blood, is non-conductive and will not damage the chips. Earlier computers used forced air cooling to control excess heat buildup.

NASA has not yet selected the second high-speed processor scheduled to be in place by 1987. This procurement will be made on a competitive bid basis.

* Microprocessor-based workstations will be used at Ames primarily to display graphics, but also to manipulate text and data. Small scale-computations also can be performed at these workstations.

The IRIS 1500 (Integrated Roster Imaging System) by Silicon Graphics, Inc. has been selected as the initial workstation model. It has a Motorola 68010 microprocessor and a proprietary "graphics engine" chip that executes graphics routines much more quickly than software can. Its multicolor display has a resolution of 1024 x 1024 pixels (television sets have about a 250 x 250 pixel resolution). The IRIS can display data from flow

(more)

calculations at a rate of more than 50,000 points per second.

* A subsystem for graphics displays of aeronautic simulations will have improved performance and additional storage capabilities as compared to the individual workstations. NASA expects it to have a 4000 x 4000 pixel resolution and the capability to generate real time graphic displays.

* Two Amdahl 5840 "mainframe" computers will handle interactions between the supercomputers and Ames users who have terminals (users with workstations will directly access the supercomputers). Users who are not at NASA-Ames will also "talk" to the supercomputers through the Amdahl mainframes and long haul communications systems.

The Amdahl 5840's also will store and distribute data files to a "mass storage" subsystem and will maintain a directory of all files stored in the NAS system. The mass storage subsystem will provide 120 billion bytes (characters) of disk memory storage.

The mainframes also will support data communications with the supercomputers at speeds ranging from 1200 bits per second to 1.5 million bits per second. Communication hook-ups will be by high speed telephone lines or by satellite.

NASA aims to provide access to its supercomputer network to off-site researchers in private industry, universities and other government agencies. The NAS User-Interface Group, representing thirty organizations from airspace industry, unversitities, NASA, the U.S. Department of Defense, and other government research centers, has participated in the NAS project throughout the program's development.

* All the computers will be operated with AT&T'S Unix System V operating system. Informatics General, Inc., will

(more)

design and develop the network software that will link the NAS computers together.

Special Features of the NAS Facility

March 14, 1985 was the groundbreaking for the building that will house the supercomputers which are the heart of the NAS network. Initial occupation of the building is set for athe end of December, 1986.

The 3-pod concrete building will have a total of 90,500 square feet, with 14,000 square feet devoted to the high speed processing computer room. The floors of this room will be built to handle twice the load of a standard computer floor.

The big computers will also place special cooling demands on the NAS building. The NAS Facility will have 2,800 tons of air conditioning equipment, whereas a normal office building of comparable size requires only one hundred tons. The term "tons" refers not to the weight of the equipment, but to its cooling capacity; the cooling power of one hundred tons of melting ice per day.

Excess heat generated by the complex multicomponent network processing system will be removed by seventeen 40-ton "air handler" units that line the walls of the central computer room. These units contain coils of pipes similar to the coils in a household refrigerator. Warm room air will be drawn in and cooled by passage over the coils, with the heat being transferred to the water within the coils. In turn, the water in the coils will be cooled by four 700-ton "chillers" located on the ground floor below the central computer room. These chillers will keep the water in the coils at a temperature of 45 to 55 degrees, and the central computer room temperature between 68 and 70 degrees.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415/694-5091
Roberta Friedman

For Release:
Immediate

Release No. 85-12

NASA-AMES TO BREAK GROUND FOR SUPERCOMPUTER BUILDING

NASA's Ames Research Center will break ground on Thursday, March 14, for the Numerical Aerodynamic Simulation (NAS) Facility building to house the world's most powerful supercomputer system.

The multicomponent NAS Processing System Network will provide a national computational capability which will complement NASA's experimental facilities to help ensure continued national preeminence in aeronautical research.

The NAS system will reach continuous, high speeds of one billion computations per second in 1988. At any given time, it will employ the two fastest supercomputers in existence. Goal for the system in the 1990's is an enormous ten billion calculations per second.

At the heart of this system, high speed supercomputers will be utilized to solve complex aerodynamical equations. These equations describe the fundamental fluid physics of large scale aerodynamic flows associated with aircraft flying in the Earth's atmosphere. In effect, aircraft configurations can be tested by "flying the aircraft in the computer." The NAS will reduce both the time and the costs of developing new aircraft.

(more)

But even today's most advanced scientific computers do not have the speed and memory capacity to predict all aspects of aircraft performance. NASA hopes its NAS program will push the supercomputer industry to develop faster, more powerful computers to further advance aerodynamic simulation.

Another important goal of the NAS supercomputer, a national facility, is to make the supercomputer network available to remote users in universities, private industry, and other government research agencies nationwide. Off-site scientists will gain access to the system by high speed telephone lines or by satellite. Other research which will be supported by NAS include computational materials and structures, weather prediction, computational chemistry, genetic engineering and computational astrophysics.

Cray Research's Cray 2 supercomputer, with an expected operating speed of 250 million calculations per second when working aerodynamic problems, is one of the fastest computers in the world and will be the heart of the initial NAS network which will become operational in mid-1986. NASA intends to incorporate even faster supercomputers as they become commercially available, keeping the NAS at the forefront of aerodynamic innovation.

The layout of the NAS building was designed to promote a unique interaction between the users and the operators of NAS. Scientists who use the computers for their research will be able to work closely with the people who will operate, maintain and develop the NAS system. In essence, NASA hopes to create a partnership between people and machines that in itself will advance computer simulation.

The 90,500 square foot concrete NAS building was designed by Hunt and Company, Architects. The contractor is Perino Company.

(more)

The building will also feature an "open office" floor plan. Its three-pod layout will include 14,000 square feet devoted to its central computer room.

Advances in logic and memory chips have paved the way for these incredible computing rates. But the rate of calculation is also limited by the time it takes for the impulses to pass from one chip to another. Theoretically, impulses can travel down a wire at speeds close to the speed of light. So packing chips close together with short interconnecting cables will produce fast computers. The problem is, crowded chips can build up enough heat to damage each other.

The Cray 2 will be the first computer to have its chips totally immersed in a fluid that draws heat away. The fluid is inert, so it does not damage or corrode the chips.

The same fluid is used by hospitals as an artificial plasma to replace human blood. "Supercomputers are like big brains, and now we have to give them blood to keep them cool," quipped Don Senzig, a member of the NAS project at Ames.

The NAS building, budgeted at $17.1 million, will be equipped to keep fast computers cool. Bronzed windows will dim entering sunlight by 50 percent to reduce the load on the air conditioning system (the tinted windows will also keep glare from bothering workstation users).

The two-story building will be divided into three "pods," according to Frank Kouba, NAS facility project manager at Ames.

On the left and right of the front of the building will be two pods facing south. They will provide two floors of quiet, open office space with separate, enclosed rooms for noisy equipment such as printers.

March 11, 1985

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release
Immediate

Peter Waller 415/694-5091
Roberta Friedman

Release No. 85-14

DAVID BLACK APPOINTED CHIEF
SCIENTIST FOR SPACE STATION

NASA-Ames' Dr. David C. Black has been named Chief Scientist for the Office of Space Station at NASA Headquarters in Washington, D.C.

Black will leave NASA's Ames Research Center, Mountain View, CA to take his new position, which begins April 15. His job will be to ensure that the Space Station will accomodate the needs of the scientists who will use it. He will advise Phillip Culbertson, Associate Administrator for Space Station, about steps to make the Space Station an accessible research facility for scientists from many disciplines.

The Space Station will be a place where people can work in space. Plans call for it to be put in orbit around Earth by 1993. The Space Shuttle will bring astronauts and materials to and from the Space Station. Unlike the shuttle, which was designed as a transport vehicle, the Space Station will provide a permanent base in space for scientific research.

(more)

Black's appointment coincides with the start of an intensive planning stage for the Space Station. Starting April 1, independent contractors selected by NASA will spend 21 months working out details of Space Station design. By involving potential users in this planning period, NASA hopes to provide the scientific community with an efficient laboratory for conducting science in space.

Other countries want to cooperate with NASA in the Space Station project. Black intends to work with the agencies that represent the interests of European and Japanese scientists, and coordinate their plans with those of NASA.

Black has been probing scientists' needs for the Space Station since April, 1984, when he joined the Task Force on Scientific Uses of the Space Station. This committee brings together 30 scientists from various universities and represents the disciplines that are interested in using the Space Station.

Black also serves on a National Academy of Sciences study called "Space Sciences, 1995-2015." This study group is attempting to identify the future directions for research in the space sciences and thereby decide which technologies will be needed to support that future research.

Black has been Research Scientist in the Theoretical Studies Branch at Ames since 1972. His own research is on theories of how planetary systems form around stars. He received his B.S., M.S., and Ph.D. degrees in Physics from the University of Minnesota.

(more)

In past duties at NASA-Ames, Black has filled the posts of Acting Chief of the Theoretical Studies Branch, and Acting Deputy Chief of the Space Sciences Division.

Black is currently editing the reports from a symposium, "Protostars and Planets II," that will be published this spring He is also writing a book for the Uniscience Series of the CRC Press.

# # #

March 20, 1985

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 965-5091

For Release:

Peter Waller 415-694-5091

IMMEDIATE

Rel. No. 85-15

Note to editors:

Work at NASA's Ames Research Center appears to suport a new theory for the origin of life on Earth. The Ames work shows that ordinary clays can store and transfer energy. The new theory is that clays may have served as proto organisms, and provided a pattern for the beginnings of organic life.

Clays have been found to have other "life like" properties in addition to energy storage.

A panel of scientists will review the pros and cons for this theory of the origin of life at a Symposium at NASA-Ames on Tuesday, April 2 at 11:15 a.m.

News reporters are invited to be in the audience. Since this is a scientific meeting, reporters will not be able to ask questions during the proceedings, but participants will be available afterwards for questions.

Symposium participants are:

Dr. Sherwood Chang, NASA's Ames Research Center
Dr. Lelia Coyne, San Jose State University
Dr. David White, University of Santa Clara
Dr. Graham Cairns-Smith, University of Glasgow
Dr. David Deamer, University of California, Davis

A news release, a television clip, and other material will be available showing various aspects of the proposed theory and the Ames work.

Reporters planning to attend should come to the NASA gate of Moffett Field, and will be directed from there to the Symposium.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field. California 94035
AC 415 694-5091

For Release:

Pete Waller 415-694-5091

12:00 Noon Tuesday

April 2, 1985

Rel. No. 85-16

EVIDENCE FOUND TO SUPPORT MINERAL ORIGIN OF LIFE ON EARTH THEORY

A discovery by NASA scientists provides additional support for an emerging new theory for the origin of life on Earth. The theory holds that clay minerals have life-like properties. NASA scientists have recently shown that ordinary ceramic clays perform two very basic processes essential to living organisms. They can store and transfer energy. These properties, although they do not prove the theory, are necessary conditions for it to be correct.

The clay-energy storage and transfer processes were discovered by a group of researchers led by Dr. Lelia Coyne of San Jose State University, working at NASA's Ames Research Center in Mountain View, Calif.

According to the new origin-of-life theory which is attributed to A.G. Cairns-Smith, of the University of Glascow, Scotland, clay minerals served as inorganic proto-organisms which were the forerunners of later organisms based on organic compounds. This "clay-life "theory is a major departure from previous origin-of-life theories. These theories propose that the very first proto-organisms formed at random from an array of organic raw materials.

The revised new theory further proposes that inorganic proto-organisms were not only precursors of organic life, but also may have provided a transitional evolutionary structure for it. That is, the theory suggests that synthesis of later living organisms based on organic compounds was initially directed by an original inorganic pattern.

(Organic compounds make up all known life forms on Earth and involve primarily the element carbon. This carbon is either bound chemically to itself, or to hydrogen, nitrogen, or oxygen. "Life" molecules also sometimes include sulfur, phosphorous and metal ions.)

The new "clay-life" theory has been supported by the reported work of other scientists, which suggests that clays may have the ability to perform additional chemical functions basic to life--beyond the long-known selection of chemicals, catalysis of reactions and the storage and transfer of energy recently found at Ames. These other suggested clay-life functions could include self-replication, growth, and transfer of chemical information to other chemical systems.

The clay-life theory of Cairns-Smith attributes virtual "life" to clays. Although many scientists are reluctant to accept the concept of inorganic proto-life forms, even the strongest skeptics think the theory deserves further investigation. The Cairns-Smith theory differs substantially from the previous "primordial soup" theories for chemical evolution.

These earlier ideas suggest that life originated from a primordial soup of simple organic molecules. After a process of "chemical evolution" lasting millions of years and involving billions of more or less random chemical reactions, a complex organic molecule that could replicate itself eventually emerged from this soup. The organic molecules in the soup were products of interactions in the primordial atmosphere between the presumed atmospheric components (ammonia, nitrogen, methane, and water vapor) and the earth's energy sources (such as lightning and solar ultraviolet rays). Once formed, the molecules supposedly were rained into the primitive oceans.

Unlike the primordial soup theory, the clay-life theory proposes that chemical evolution of life was patterned, not random. It suggests that rudimentary life processes were first associated with clays. Previous work elsewhere and at NASA-Ames has indicated that clays could have helped to select and concentrate the raw materials of life, and then templating further reactions of these raw materials together with organic compounds. Only later were life processes assumed by complex organic compounds, such as proteins and nucleic acids, capable of

carrying them out more efficiently.

Preliminary experiments reported informally in 1981 by University of Munich chemist Armin Weiss may support the clay-life theory. Weiss's sketchy published reports suggest that the structure and crystal size of the "parent" clay seem to have been reproduced in subsequent "generations" of "daughter" clay. Additionally, Weiss's work claims to show that "daughter" clay catalyzes the same reactions as its "parent." It is possible that his work marks the first observation of an inorganic chemical system capable of self-replication with rudimentary transfer of information.

The NASA-Ames discovery of energy storage and transfer in clays introduces a new and important aspect to the clay-life theory--in addition to clay's long-known ability to act as a catalyst and its suggested potential for self-replication.

The new evidence from Ames for energy storage and transfer shows that clay minerals are capable of engaging in energetic processes which are necessary conditions if it is to be shown that clays have lifelike properties.

These minerals acquire energy from the environment, store it in the bulk mineral, and transfer it to the mineral surface. In this way, energy could have been made available for "clay-life" processes, and also for organic reactions on the surfaces of clays. The energy could have been used to form primitive organic proto-organisms.

Evidence for the energy storage and transfer has been gathered by several means. Ultraviolet light release, prolonged

over minutes to days, is observed when clays are: wetted with organic liquids or water, or dried, ground-up, fractured or gamma-irradiated. The capacity to release light is diminished by heat-treatments, but restored by gamma-irradiation.

Energy storage is evidenced by the long-term nature of the light release after the provoking trigger. That the original energy storage is in the bulk clay, not on its surface is indicated by the type of signals observed from the heat-treated and gamma-irradiated clays. That the stored energy can be transferred to the surface is evidenced by the fact that superficial triggers, like wetting and drying, provoke light release. The possible availability of this energy for surface reactions is supported by early data, which shows that the formation of amino acid chains, small peptides, is speeded up when the clay catalyst is gamma-irradiated before the reaction.

These energetic properties of clay furthermore suggest the possibility that formerly neglected geological energy sources may have been important in prebiological chemistry.

Coyne proposes that clays scavenge energy which would other wise be dissipated in natural processes. For instance, clays moderate and store energy released during natural radioactive decay. Work of the Ames team and that of others has shown that light energy is released from clays and other minerals under conditions characteristic of earthquake activity, seasonal cycles of freeze-thawing, tidal cycles of wetting/drying and erosion. Possibly this mechanical energy associated with rock movement may be acquired and stored, as well as released.

The ability of clay minerals to store and transfer energy appears to be achieved through the temporary capture of highly energetic electrons by irregularities in the clay structure. These irregularities are actually defects in the structure of the mineral, such as atomic substitutions and irregularities in crystal growth. Clays tend to be loaded with atomic substitutions. This facilitates detection of energy storage. Interestingly, notes Dr. Coyne, these are the same types of defects which have been associated with the processes of catalysis and replication.

This current NASA-sponsored investigation with clays grows out of twenty years of research involvement of Ames scientists in studies of the chemical basis for the origin of life. Scientists besides Coyne recently involved in various aspects of clay research at Ames include Drs. Sherwood Chang, Ted Bunch, James Lawless, Noam Lahav, David White, and Glenn Pollock.

The clay-life theory provides a testable alternative to the "primordial soup" theory. This theory was set forth originally in the 1930's by Russian scientist A.I. Oparin. The "soup" theory has long been favored by many scientists. But more recent geochemical findings suggest that the ammonia and methane needed for the theory to work were not abundant in the Earth's early atmosphere.

Critics cite the lack of evidence for abundant ammonia and methane in ancient rocks of the Earth, Moon or meteorites. They point out that these two gases would not have lasted long in the atmosphere as a result of their ready destruction by solar

ultraviolet light. They also argue that the primordial soup theory exaggerates the chances of having a sufficient concentration of the "life" compounds held together in one place for a long enough time for life to begin.

Dr. Coyne notes that the "clay"-life theory is by no means the only mineral-life alternative:

"There is nothing inherent in clays that would make them theonly minerals capable of carrying out the chemical processes that led to life. But clays do have some special properties among minerals."

"To 'live,' an organism must achieve an adaptive balance between its internal structure and pressures from its environment," says Coyne. "Since the ability of clays to store and transfer energy is affected both by internal structure, including defects, and by the environment, clays hold promise for clarifying the environment's role in chemical evolution."

- end -

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter W. Waller 415/694-5091

For Release

Immediate

Release No. 85-18

AERONAUTICAL RESEARCH LEADER
DE FRANCE DIES

Dr. Smith J. De France, first Director of NASA's Ames Research Center and long the country's leading designer of large wind tunnels for aeronautical research, died yesterday at his home in Los Altos. He was 89.

Born in Battle Creek, Michigan in 1896, De France interrupted engineering studies at the University of Michigan to fly Spads for the Army Signal Corps in World War I and win a Silver Star. Upon graduation in 1922 with a B.S. in aeronautical engineering, he joined the National Advisory Committee for Aeronautics, the NACA (predecessor agency to NASA) at the Langley Aeronautical Lab, Langley Field, Virginia. This began a 43-year career with the NACA and NASA, which made him an international authority in wind tunnel design, construction, and operation.

At Langley, he designed the 30 by 60-foot wind tunnel, the largest ever built at that time. He designed other tunnels at Langley and, in 1939, was chosen to plan and supervise construction of the country's second aeronautical research center, the Ames Research Center in Mountain View, California. De France was named as the first director of Ames in 1940, where he presided over design and construction of the 40 by 80 foot tunnel at Ames, the world's largest wind tunnel.

(more)

Both the Langley and Ames big tunnels are large enough that researchers can test full-scale aircraft inside them (with the engines running if desired). These big tunnels were used in many of the important advances in aeronautics during the 1930's, 40's and 50's because they could closely simulate actual flight of real airplanes.

Known by virtually everyone in the field as "Smitty," and for many years a landmark figure in aeronautics research, De France had a career which spanned the period of virtual U.S. dominance in aeronautical progress. At Ames some nineteen major wind tunnels were built under his leadership, spanning aircraft speed ranges from a few hundred miles per hour, to several times the speed of sound. Eventually, in the late 1950's and early 60's, Ames tunnels solved various problems of rocket flight, perhaps most noteworthy, how to bring a spacecraft back into the Earth's atmosphere from orbit without burning it up. Under De France, in the early 1960's, spacecraft models flew at speeds up to 25,000 mph (Earth escape speed) in Ames tunnels, and the first flight of the Apollo command module configuration took place in an Ames hypervelocity tunnel.

Dr. De France retired as a director of Ames in 1965, age 69.

His first work, at Langley Aeronautical Lab, (now Langley Research Center), involved air flow problems with dirigibles. He carried out a variety of full-scale aircraft research programs in the big wind tunnels both at Langley and Ames. He was always a proponent of flight research with full-scale models versus that with smaller scale test vehicles, because of the much greater reliability of the results.

While De France was Director, Ames also became the NASA center responsible for basic research in the life sciences, and broadened its research into a number of fields in space sciences.

(more)

Dr. De France received the Presidential Medal of Merit in 1947 for "outstanding success in designing and building the Ames Research Center, for organizing its staff into effective research teams, and for leadership in directing research programs in high-speed aerodynamics applied to the development of faster airplanes."

He received the honorary degree of Doctor of Engineering from the University of Michigan in 1953 in recognition of his outstanding career in aeronautical engineering.

In 1952, the University of California awarded him the honorary degree of Doctor of Laws.

He was an Honorary Fellow and Vice-President of the American Institute of Aeronautics and Astronautics, and a member of the American Association for the Advancement of Science, Sigma Xi, and Tau Beta Pi.

Dr. De France received the 1964 Career Service Award of the National Civil Service League, a non-government organization dedicated to improving public administration.

He is survived by Jeanne Keel of Paynes Creek, Jim Padelt of Cupertino, JoAnne Thompson of Scotts Valley, Jane Hansen of Los Altos and John Padelt of Ben Lomond, California.

#######

(Photograph available upon request)

May 7, 1985

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 694-5091

Evvie Rasmussen

415-694-5091

Release No. 85-20

For Release:

Immediate

AMES RESEARCH SCIENTIST NAMED SHUTTLE MISSION SPECIALIST

Tamara E. Jernigan, research scientist in the Space Sciences Division of NASA's Ames Research Center, has been named one of 13 newly appointed astronaut candidates.

Jernigan, 26, is one of seven mission specialists (scientist-astronauts) who will report with six new pilots to Johnson Space Center in Houston August 1 to begin a one-year training and evaluation program. Once the year's training is successfully completed, the candidates will be eligible for Space Shuttle flight assignments. Jernigan is one of two women in the new group of candidates. They join 90 current members of the astronaut corps.

Jernigan is currently pursuing a Ph.D. in the Department of Astronomy at the University of California, Berkeley. She holds a bachelor of science degree in physics and a master's degree in

-more-

engineering science, both from Stanford University, as well as a master of science in astronomy from UC Berkeley.

Jernigan was born in Chattanooga, Tenn. She is the daughter of Mary P. Jernigan of Santa Fe Springs, Calif., and Terry L. Jernigan of Lynwood, Calif.

#####

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field California 94035
AC 415 694-5091

Peter W. Waller 415/694-5091

Tracey Kaplan

For Release:

Immediate

Release No. 85-25

SHUTTLE MISSION 51-F CARRIES SPACE GARDEN

NASA scientists will be a step closer to growing food in space after conducting a plant growth experiment on Spacelab 2.

Using two miniature greenhouses called Plant Growth Units, investigators will monitor the effect of weightlessness on the direction of plant growth and on the formation of lignin, a woody substance in plants that allows them to grow upward against the pull of gravity.

Plant growth in zero gravity interests NASA scientists because it may be more cost-efficient for future space colonies to grow food in space than to ship it in.

Although growing food in space is one of NASA's long-term goals, determining the effects of microgravity on the production of lignin is the immediate goal of project manager Edward Merek and project engineer Ronald Mancini, both of NASA's Ames Research Center, Mountain View, California. The principal investigator is Dr. Joe R. Cowles of the University of Houston.

(more)

July 29, 1985

Controlling lignin, a structural polymer that makes up as much as 30 percent of plant tissue, is economically attractive because lignin interferes with extraction of wood fibers for the production of paper. It also reduces the use of certain plants as food because humans cannot digest it.

A similar experiment performed during the third Shuttle mission (STS 3) showed that space-grown mung beans had 15-22 percent less lignin than a control group of mung beans grown on the ground. The space-grown oat and pine seedlings had only a slight, insignificant reduction of lignin.

During Spacelab 2, twice as many plants (192) will be carried aboard the orbiter Challenger in rectangular, terrarium-like chambers. Oat and mung bean seeds and young slash pine seedlings will be planted twelve hours before launch in twelve plant growth chambers.

Sixteen seedlings will be planted in each chamber, in sandwiches of moist foam padding and filter paper. The chambers will be sealed and placed in the Plant Growth Units, which will be loaded late in the launch countdown into locker spaces on the forward bulkhead of the orbiter's mid-deck.

Aside from the increased number of plants carried on the mission, another difference between this experiment and the first is in the amount of light the plants will receive. During the first experiment, plants were exposed to fourteen hours of artificial sunlight. Without a gravity cue, some plant roots grew upward in space, and some shoots grew crooked.

(more)

This time the growing period during the seven-day mission will be lengthened to twenty-four hours of light daily to provide additional growth for scientists to analyze. Unlike the first experiment, the Spacelab crew will take photographs twice of the plants' orientation and send video images to the control center while in flight. The crew will also take gas samples and check temperatures inside the growth chambers.

Immediately after the Challenger lands, the units will be removed, and the plants will be photographed and analyzed. Results will be compared with those from identical Earth-grown seedlings.

The Plant Growth Units were built by Lockheed Missile and Space Company and the Life Sciences Flight Experiments Project Office at Ames Research Center. The project office, managed by William Berry, is responsible for all non-human experiments aboard the Space Shuttle. The office is part of the Ames Space Sciences Division.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 694-5091

For Release:

Peter W. Waller 415/694-5091

12:00 p.m. PDT, October 8, 1985

Linda Blum

Release No. 85-28

WATER PLAYED A MAJOR ROLE ON MARS

Ice, snow, flowing rivers and vast lakes may have played a major role in shaping the ancient Martian surface and climate, a panel of scientists reported today at NASA's Ames Research Center, Mountain View, Calif.

According to these new ideas about Mars, a thick layer of snow may have girdled the Martian equator in the planet's early years. Melted water running from beneath this snowpack may have carved out Martian "rivers," the extensive winding channels photographed by Mariner 9.

In addition, huge ice-covered lakes may have formed in canyons near the Martian equator early in the planet's history, scientists believe. Primordial Mars may have been warm enough to support flowing rivers and lakes on its surface.

(more)

Today, there is evidence that ice extends deep into the ground in regions above 30 degrees latitude, while liquid water may exist half a mile beneath the surface, scientists say.

The scientific presentation today grew out of research discussed at the Water on Mars Workshop, which brought 83 scientists to NASA-Ames last winter--as well as from more recent work in the field.

Early in Martian history, according to Bruce Jakosky of the University of Colorado at Boulder, the Martian poles were tilted more directly toward the Sun than they are today. As a result, the polar ice caps may have sublimed into the atmosphere (changed directly from a solid to a gaseous state) during the continual daylight of polar summer.

Vapor from the caps would have been carried by Martian winds to the equatorial regions. At equatorial latitudes, where night always alternates with day, the chill of nightfall would have precipitated water vapor as snow, Jakosky said.

Gary Clow of the U.S. Geological Survey in Menlo Park, Calif., reported that an equatorial snowpack could have been heated by sunlight trapped inside the snow fields. A reflective, insulating blanket of snow can trap sunlight, much as a greenhouse holds the Sun's warmth. Thus, even if the surface of Mars had still been cold, melting beneath an insulating snowpack could have let water escape to carve the 'valley network' channels of Mars. These 'valley network' channels as well as

larger outflow channels--both strongly resembling dry riverbeds on Earth--were photographed by Mariner 9 in 1972.

The larger outflow channels are thought to have been created by sudden release of enormous amounts of subsurface water, which may have dug the channels in a matter of weeks. The 'valley network' channels, which Clow has studied, are smaller and may indicate the existence of a more moderate climate on early Mars, allowing liquid water to flow for long periods of time.

Huge ice-covered lakes also may have existed on the ancient Martian surface in the immense Valles Marineris canyon system, according to Steven Squyres of Ames. Viking photographs of the floor of these canyons, Squyres said, reveal thin, flat-lying layers of sediments which appear to have been laid down in liquid water.

Today, Mars is so cold that all water on its surface freezes. Although the Martian atmosphere is 95 percent carbon dioxide, an effective infrared absorber, it is so thin that it cannot trap the heat of the Sun.

Dry ice, solid carbon dioxide, covers the polar regions of Mars. Beneath the northern cap, and perhaps under the southern polar cap as well, lies water-ice. The water-ice at the northern pole is revealed when the overlying dry ice vaporizes each summer.

Water-ice in the Martian polar caps does not melt because temperatures rarely climb above freezing, except at the

(more)

equator. It sublimes directly into the atmosphere, forming wispy clouds on Mars. Earth's billowy clouds are formed by tiny droplets of liquid water.

Today, ice is present in the Martian ground in regions above 30 degrees latitude, according to Squyres and Michael Carr of the U.S. Geological Survey. Examining Viking photographs of impact craters, Squyres and Carr found evidence of "terrain softening"--a rounding-off of features indicating water activity beneath the surface.

Terrain softening of smaller, more recent craters suggests that ice remains present today in these northern and southern regions. Like the tundra of Alaska, this deeply-frozen ground never thaws.

The presence of ice indicates that liquid water exists on Mars--deep within the planet, according to Carr. Half a mile beneath the surface, water in the pores of Martian rocks is liquid, Carr says. It is heated by the high temperatures present at these depths in the Martian crust.

Robert Haberle of Ames is studying the distribution of water on Mars today. He is using data gathered by the Viking orbiters which measured seasonal changes in the amount of water vapor in the Martian atmosphere. Haberle is trying to simulate the Viking data by modelling the Martian climate on a computer, using both the known pattern of winds that blow over Mars and the fact that the northern polar cap partially sublimes from solid to gaseous carbon dioxide each summer.

(more)

So far, Haberle has found that water lost by the north polar cap during summer is not fully recovered in the winter. He wants to determine where this water goes.

Movement of water and carbon dioxide to and from the polar ice caps and movement into and out of the rubbly Martian ground may be responsible for the mysterious "layered terrains" that fringe the polar caps on Mars.

In winter, carbon dioxide condenses over the polar region, depositing a layer of mingled ice and dust. This layer then becomes cemented into place by water-ice and remains when the carbon dioxide evaporates again in the spring. Periodic changes in the Martian climate, caused by fluctuations in the planet's tilt toward the Sun, can alter the amount of gas which condenses, thus creating layers of varied sizes.

According to James Pollack of Ames, the Martian climate in the past may have been warmer and wetter. An earlier Martian atmosphere may have been much thicker, with more carbon dioxide to hold the Sun's warmth. Rivers and lakes of liquid water could have dotted the ancient Martian landscape.

A complex geochemical cycle may have maintained this warm climate for as long as half a billion years, Pollack says. The liquid water then present would have speeded up weathering of rocks, enhancing chemical reactions that take carbon dioxide out of the atmosphere and incorporate it into minerals. But, heat from lava flows coming up from the interior would have decomposed

(more)

the carbonate rock, returning CO_2 to the atmosphere, Pollack says. (On early Mars, whose crust was relatively thin, lava could have come up almost anywhere on the planet.) In certain conditions, Pollack says, the flowing lava would have buried the carbonate rocks, bringing them to a depth where they would have been decomposed by the planet's internal heat. The lava action would have been great enough to release sufficient carbon dioxide to keep the cycle going in early times, according to studies by Pollack. Eventually, however, Pollack says, the lava flow rate on the small planet dropped, and the CO_2 became locked up in the rocks.

With the loss of carbon dioxide from the Martian atmosphere, heat would have escaped the planet's surface, cooling the planet and freezing its water.

Peter Schultz, of Brown University, suggested that some of the Martian atmosphere may have been lost due to a cataclysmic impact. The impact that created the immense Argyre basin on Mars may have perturbed the Martian climate by blowing into space a significant part of the atmosphere. Schultz noted that Martian terrains, formed after the Argyre impact, have fewer dry channels than older terrain, a feature that suggests a major climatic change at that time.

Besides Earth, Mars is the only planet in our solar system that experiences cyclical changes in climate. Understanding past and present conditions on Mars will help scientists decipher Earth's climate, says Haberle.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release:

Debra J. Rahn
Headquarters, Washington, D.C.
(Phone: 202/453-2754)

September 9, 1985

Donald G. James
Ames Research Center, Mountain View, Calif.
(Phone: 415/694-5091)

RELEASE NO: 85-32 *

SIDESTICK CONTROL EVALUATION COMPLETED FOR TILT-ROTOR AIRCRAFT

The NASA/Army XV-15 Tilt-Rotor Research Aircraft, with a sidestick controller installed, has been flown successfully with the aircraft's stability control system both operative and inoperative. The 9-day flight evaluation took place at NASA's Ames Research Center, Mountain View, Calif.

The objective of the XV-15 Tilt-Rotor Research Aircraft Program is to develop and evaluate tilt-rotor technology for civil and military applications. A tilt-rotor aircraft can lift off vertically like a helicopter and then, by rotating its rotor thrust from the vertical to the horizontal position, fly like a conventional airplane at speeds up to 345 miles per hour.

The purpose of the sidestick control system evaluation was to provide data for the V-22 Osprey, a tilt-rotor aircraft being developed for the Department of Defense, according to NASA-Ames tilt-rotor group leader L.G. Schroers. DOD will consider these flight test results when deciding whether to use a sidestick controller in the V-22.

The stability control augmentation system (SCAS) reduces pilot workload, allowing him to devote his attention to other tasks. If the SCAS fails, the pilot must provide the stability commands as well as the control commands. One primary question answered by this research project was could a tilt-rotor aircraft be flown with a sidestick controller after the SCAS has failed.

- more -

Results from the flight evaluation indicated the sidestick controller is a viable system for controlling the aircraft with or without the SCAS. Schroers declared that the two-axes (pitch and roll) sidestick controller is as good as or better than the centerstick control system normally used in the XV-15 research aircraft.

When the third axis (yaw) was added to the sidestick controller, however, pilots noted a significant increase in work-load, indicating that additional studies are necessary in this area.

The sidestick controller system uses onboard digital computers and electronics which replace the mechanical linkages that normally translate pilot signals to the aircraft's control surfaces. The system was developed for this research project by Gary Churchill of Ames and will be refined and re-evaluated during future control system studies.

The XV-15 Tilt-Rotor Research Aircraft is a unique research tool providing valuable data for production tilt-rotor aircraft.

- end -

Note: NASA-Headquarters release number: 85-124

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

Peter Waller 415/694-5091

For Release
Immediate

Rel. No. 85- 37

Note to editors:

What is currently the world's fastest and most powerful supercomputer, the Cray-2, model 2002, has arrived at NASA's Ames Research Center. The new machine can perform 250 million continuous calculations per second, more than three times faster than the previous generation of supercomputers. It will allow major steps toward simulating actual aircraft flight in a computer. It will make possible important advances in aircraft design, in both cost savings and aircraft performance. It is unique in having a huge memory of 256 million 64-bit words. This means it can handle 256-million-word problems, 16 times larger than problems handled by previous supercomputers.

At 10 a.m. Wednesday, October 2, news reporters and photographers will be able to view the new machine and be briefed on its functions.

The new supercomputer is the first major building block in the creation of NASA's NAS system, a combination of large, advanced components, planned as the world's most powerful computer system. NAS is expected to perform one billion computations per second (known as a "gigaflop") by late 1987. In addition to its important advantages for aircraft design, the NAS system represents a major national facility for such research as computational chemistry, weather prediction, and genetic engineering.

MORE

These computer applications (especially the huge demands of aircraft design for computation speed) represent a driver for big computer development in the U.S. Aeronautics is the biggest single U.S.export. The NAS system is planned as an ongoing project: to encourage development of new supercomputers by the industry, to maintain U. S. leadership in the field, and to meet international competition, especially Japanese.

Colorful computer graphic demonstrations of the type of simulations the Cray-2 is expected to perform will be available. Videotape and still photos will be provided including dramatic, moving computer graphics and examples of computer-aided flight projects--including one involving the Space Shuttle.

Videotape and still photos will also show the extremely delicate handling required during delivery and installation of the remarkably small (4 feet high, 4 feet in diameter), $17 million machine.

(The Cray-2's predecessor supercomputer is represented by just one circuit board in the new device. Earlier big, fast computers occupied entire buildings. The new machine is basically twice as fast as its predecessors because of its small size. The Cray-2 takes 4.1 billionths of a second per computation, compared with 9.5 billionths of a second per computation for previous machines. The speed of light is the limit on computer speed, so that faster machines have to be smaller to reduce distances of information travel. Computer scientists say they can get still more speed by further size reductions. But probably the greatest potential for speed-up now is addition of more parallel processors.)

Reporters planning to cover arrival of the new machine should come to the NASA gate of Moffett Field. They will be directed to the computer building which houses the Cray-2.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 965-5091

For Release

Peter W. Waller 415-694-5091

Rel. No. 85-38 October 2, 1985

NASA-AMES GETS SUPER-FAST COMPUTER--BUILDING BLOCK FOR NAS

The world's fastest and most powerful supercomputer, the Cray-2, serial no. 2002, has arrived at NASA's Ames Research Center. The new machine can perform 250 million continuous calculations per second, more than three times faster than the previous generation of supercomputers. It will allow major steps toward simulating actual aircraft flight on a computer. It will make possible important advances in aircraft design, in both cost savings and aircraft performance. It is also unique in that it has a huge memory capacity of 256 million 64-bit words.

The new supercomputer is the first major building block in the creation of NASA's Numerical Aerodynamic Simulation (NAS) program, planned to provide the world's the world's most powerful large scale, high speed processor system. In addition to its important advantages for aircraft design, NAS represents a major national facility in such research areas as aerothermodynamics

computational chemistry, atmospheric modeling and other computationally intensive scientific applications.

These scientific computer applications (especially the huge demands of aircraft design for computation speed) represent a major driver for the U.S. supercomputer industry, which is facing increasing international competition, especially from Japan.

The NAS system is planned as an ongoing project with continuous improvements in speed and memory. Its objectives are:

1. To establish and maintain a leading-edge national computational capability to ensure leadership in computational Fluid Dynamics and related disciplines; 2. Provide an integrated processing system capable of a sustained 250 million floating-point operations per second processsing rate in 1986 and a one billion rate in 1987; 3. Act as a pathfinder in advanced, large-scale computer systems capability.

The new High Speed Processor-1 (Cray-2) is remarkably small (4 feet high, 4 feet in diameter). The small size is made possible by microminiaturization of the electronic circuits and extremly dense packing of the circuit boards.

The new machine is much faster than its predecessors because of the compact packaging of its components (The speed of light is

a fundamental limit on computer speed. This means that super fast machines have to be smaller in order to reduce distances of information travel.) Computer scientists say they expect to get still more speed in future machines by further size reductions and with the addition of more parallel processors.

Main features of the High Speed Processor-1 include its huge, random-access memory, 16 times larger than previous super computer memories. The Processor's memory provides random access from any of the machine's four main processors and any of its high-speed data channels. This means that any user can use all or part of this memory rapidly. In previous systems, data access for large calculations could often take hours.

A second main feature is that the machine's electronic components are immersed in a cooling liquid, the first such design in history. The computer's integrated circuit packages are immersed directly in a colorless, odorless, inert fluorocarbon liquid, the same kind used as an artificial plasma to replace human blood. Liquid-cooling is necessary because components are closely packed for greater operating speed. The packed-together components generate a lot of heat, and the circulating liquid dissipates that heat.

The new machine can do either scalar processing (each computation is finished before next starts) or vector processing. In vector processing, a problem can be thought of as

a "pipeline" with parts of the problem being operated on individually as they move along through the computer "pipeline." Vector and scalar processing can be combined with the machine's ability to do parallel processing. Problems can be split in four parts and each of its four processors can work concurrently on each part of the problem, or individual processors can simultaneouly work on different problems.

The High-Speed Processor also has a built-in foreground processor which coordinates data flow between system memory and all external devices, resulting in improved speed and efficiency.

The machine's advanced architecture arranges components in three dimensions compared with conventional computer architecture, which employs two-dimensional boards. The three dimensional arrangement allows components to be positioned closer together for higher speeds.

The High-Speed Processor's memory, computer logic, and DC power supplies are integrated into a mainframe composed of 14 vertical columns arranged in a 300 degree arc ("C" shaped). The upper part of each column contains a stack of 24 modules and the lower part contains power supplies for the system. Total cabinet height, including the power supplies, is 45 inches, and the diameter of the mainframe is 53 inches. The Cray-2 weighs 5500 pounds.

The machine is unusually reliable because its cooling system allows computer chips to operate at around 90 degrees F, instead of the 150 degrees or hotter for most computers. Chips operated at cooler temperatures last far longer. The Processor also uses high-density memory chips and extremely fast silicon logic chips.

The High-Speed Processor's Unix format operating system was chosen because Unix can run on far more computers than any other operating program. This will allow the Processor to service the largest number of outside users.

PHYSICAL CHARACTERISTICS

-- occupies 16 sq. ft. of floor space
-- stands 45 inches high; diameter, 53 inches
-- weight: 5500 pounds
-- 14 columns in a 330°, C-shaped arc
-- liquid immersion cooling
-- 16-gate array logic chips
-- 3-dimensional modules
-- 195 kw power consumption
-- 400 Hz power from motor generators
-- chilled water heat exchange

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 694-5091

For Release:

Peter W. Waller 415/694-5091

Immediate

Release No. 85-39

To: Editors

It now appears that the planet Mars has had substantial amounts of water throughout its history--and that considerable water remains on the planet today.

While there have been suggestions of water action ever since the Mariner fly by in 1972, recent work greatly increases the likelihood of major amounts of water on the apparently dry and dusty red planet. This should have important consequences for unmanned and manned Mars missions, and in the very long range for possible colonization of the planet.

A scientific briefing on new findings on Mars water will be held at NASA's Ames Research Center on Tuesday, October 8, 1985, at 10:00 a.m.

Participants are authorities on Mars and are broadly familiar with work of other scientists in the field as well. They are: Dr. James Pollack, NASA-Ames; Dr. Michael Carr, U.S. Geological Survey, Menlo Park; Dr. Bruce Jakosky, U. of Colorado, Boulder; and Dr. Robert Haeberle, NASA-Ames.

(more)

The four-man panel of scientists will summarize results of last winter's "Water on Mars" conference at Ames, attended by 83 Mars experts. They will discuss conclusions growing out of work presented at this conference, as well as subsequent Mars findings.

There is evidence that ice extends deep into the ground in Martian regions above 30 degrees latitude, while liquid water may exist half a mile beneath the surface.

Detailed explainations based on substantial data now exist for the "valley network" of "water channels" on Mars, and for the larger outflow channels, which are prominent on the planet. Both strongly resemble dry river beds on Earth. Further Mars work seems to suggest huge dry lake beds on the planet.

News reporters and photographers planning to attend the science briefing should come to the NASA gate of Moffett Field, where they will be directed to the Space Sciences Auditorium, Bldg. N-245. Videotape of Mars surface features, showing action of water will be available, as will still photos and maps and diagrams of the planet.

NASA News

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035
AC 415 694-5091

Peter W. Waller 415/694-5091

Linda Blum

For Release:

Immediate

Release No. 85-48

NASA-DEVELOPED ANALYZER MAY AID BONE TREATMENTS ON EARTH

An instrument has been developed by NASA scientists and a Stanford University engineer that may aid in treating bone fractures and bone-weaking diseases, including early diagnosis of osteoporosis which afflicts millions of the elderly.

The instrument, which measures bone mass and stiffness, was developed to help scientists combat the bone loss that may occur during long-term space flight. It will be useful for manned space stations and extended space journeys, such as trips to Mars.

Known as the Bone Stiffness Analyzer, the instrument is based on the idea that the bone behaves as a structural beam. Well-developed concepts for testing the stiffness and displacement properties of structural beams can be applied to measuring the same properties of leg and arm bones.

The theory initially was demonstrated by Dr. Donald Young, a physiologist at NASA's Ames Research Center, Mountain View, Calif. Dr. Charles Steele, professor of mechanical engineering at Stanford University, adapted the instrument for clinical application.

After further tests, Young and Steele plan to use the instrument to create an exercise program for maintaining bone

-more-

strength during the weightless environment associated with extended spaceflight missions when bones tend to atrophy.

Young hopes to develop a program efficient enough to place the necessary stresses on bones through short periods of daily exercise. "It would be great if it could be done in an hour a day," Young says. He believes a trampoline-like device, with restraints to hold the body, may be effective.

Eventually, the analyzer itself may be taken into space where astronauts could test their own bone strength, perhaps determining when they may need to return home.

Since the analyzer responds quickly -- a test takes less than 1 minute and does not damage the bone or tissue--it may have wide applications for screening diseases such as osteoporosis. Osteoporosis, which weakens bones, usually is diagnosed after a fracture has occurred, when the disease already is well advanced. Though the bone analyzer cannot be used on the spine where osteoporosis often is first manifest, it can detect the disease long before X-rays, which do not show evidence of change until at least 20 percent of the bone has been lost. Steele is now planning to adapt the device for use on fingers, which also show early evidence of the bone disease.

Osteoporosis commonly affects the elderly and post-menopausal women. Heart transplant patients also experience osteoporotic symptoms, a side effect of medication to prevent the immune system from rejecting the new heart. Renal dialysis patients, whose metabolism is impaired, suffer similar effects.

Since the analyzer can be used to monitor the bone's strength as its heals, it also may aid in the treatment of fractures. A healing bone is less stiff than normal. But, if the bone is protected and immobilized too long, there is a risk of disuse atrophy. If, on the other hand, normal activity is resumed too early, refracture may occur. The analyzer's quantitative measure of bone strength could replace the

combination of inferences and guesswork now used in determining when to remove a cast.

The analyzer functions by gauging the bone's resistance to a small amount of pressure applied to the forearm or leg bone (ulna or tibia). To operate the instrument, the subject's arm or leg is positioned so the ends are immobile. The instrument's probe, consisting of an iron core wrapped with wire, is placed at mid-shaft, and a current is run through an electromagnetic "shaker," causing the bone to vibrate. The bone's displacement is then measured by a microprocessor, which analyzes the response using algorithms stored in its memory, deducing the bone's stiffness and effective mass.

Stiff bones are strong, while less stiff bones are more liable to break. Normally, bone stiffness also is associated with mineral content -- amounts of calcium and phosphorus -- and thickness. In illness, however, the correlation may break down.

Some diseases may cause mineral loss, while the bone matrix is undisturbed. In others, the bone itself may lose mass. The NASA instrument may be used in combination with bone-mineral analysis techniques to elaborate the relationship among bone strength, mineral content and disease.

The analyzer is designed for use on the long limb bones because they are close to the skin's surface, with only a thin layer of soft tissue covering them. Skin and subcutaneous tissue mask the response of the bone to the vibrating probe. Even in the long bones, the thin layer of tissue serves as a spring between the bone and the probe.

Steele believes this problem -- early on seen as a major practical impediment -- has been mitigated by careful analysis of the responses of the tissue and bone. Since the soft, fatty tissue vibrates at a higher frequency than the bone, the microprocessor can identify its effect. "If we're clever with the analyzer, we can recognize the fat," Steele says.

-more-

After 3 years of clinical testing on more than 300 subjects, Steele believes the device is now at a useful level of precision. "We're getting meaningful results," he says. "We've gained quite a bit of understanding."

Young and Steele have begun working with the device to study the effect of bone usage on bone stiffness and mass. They have examined subjects who use one limb more than the other, including an Olympic gold-medalist shot-putter and an iron-worker who uses one arm to wield a hammer. They found differences of 20-25 percent between well-used and less-used limbs, showing the benefits of physical activity in increasing bone mass. Studies of subjects, who have experienced disuse of a bone due to illness, showed losses averaging 20 percent and ranging up to 60 percent of bone mass, confirming the adage "Use it or lose it".

To find normal values for bone stiffness, Young and Steele also have tested participants in the Stanford Invitational Rugby Tournament in 1984. The players had "great tibia," Young said. In the coming year, more tests on healthy subjects will be conducted including Stanford University athletes. Young and Steele also have begun a data search to find normal "loads," the amount of stresses and strains needed to maintain healthy bones. When the search is complete, they will begin work on the exercise program for space travelers.

Maintaining bone and muscle fitness in space is the major challenge in space medicine today, Young says.

###